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THE MANUFACTURE OF PLASTER OF PARIS.

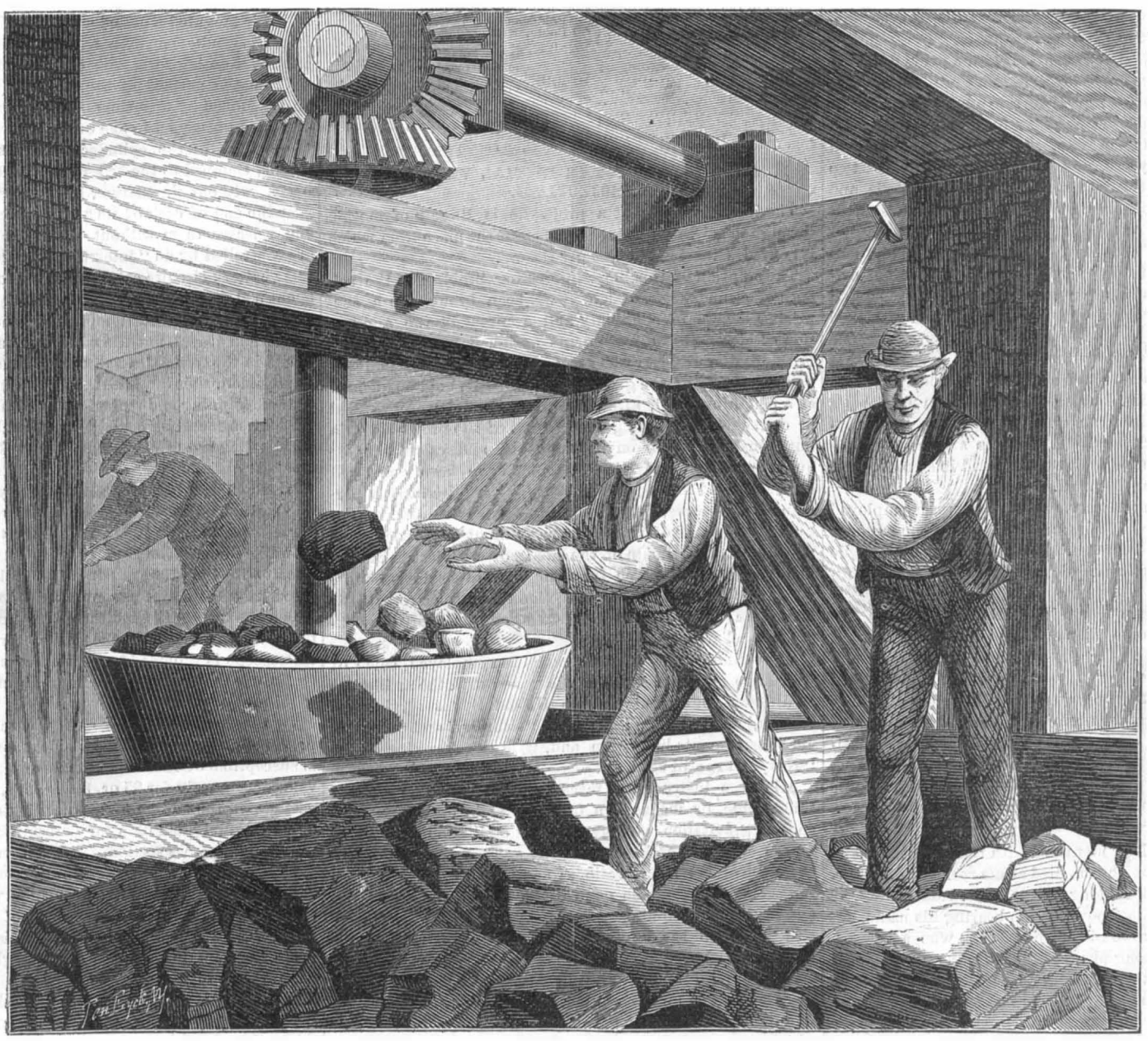
BY J. F. GESNER, M. A.

Gypsum is a mineral, very widely and abundantly disseminated, whether as the snow white, translucent, and massive alabaster, the transparent, crystallized selenite, the fiberous, beautiful satin spar, or the ordinary amorphous, rather soft plaster stone. It is only when ground and calcined that the term plaster of Paris is applied to it, from the great extent of gypsum existing at Montmartre, near Paris, where it has been worked for a long time.

The many beautiful objects of art into which alabaster is formed, such as vases, monuments in churches, statues, etc., are familiar enough to many. The softness of the stone, and its rapid deterioration when exposed to the weather, render it adapted only for statuettes and other small works of art, or for those which are not intended to be exposed to excessive moisture or climatic influences.

The crystallized and transparent form of gypsum, frequently found in large deposits of the ordinary stone, is known as selenite, from *selene*, the moon, on account of its reflecting a soft moon-like luster. This variety is capable of splitting up into thin laminæ or leaves, sometimes of large size.

The beautiful satin spar is a fiberous variety of gypsum, and exhibits a fine play of light, like lustrous satin. It is used for necklaces, inlaid work, and other ornamental purposes, though it is easily scratched and its beauty destroyed. Anhydrite is the term applied to a hard compact variety, which is remarkable from the fact of its containing no water; it is consequently inapplicable, as will be seen more clearly presently, for the process and uses which we are about to describe.



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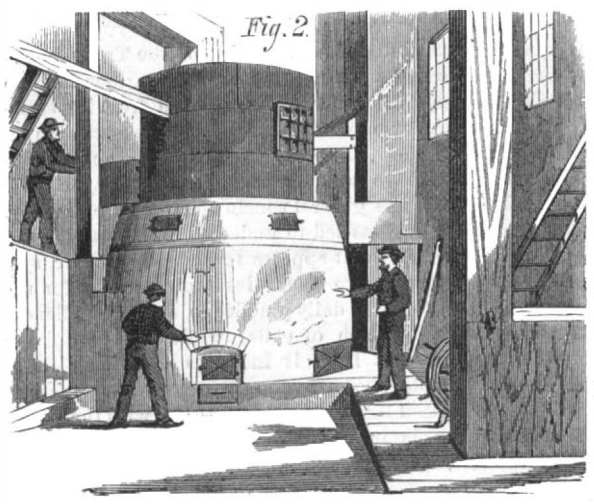

Fig. 2.

The ordinary amorphous form of gypsum, or plaster stone, of which we have to treat in this article, is a sulphate of lime, containing, in 100 parts, 46·51 parts sulphuric acid, 32·56 parts of lime, and 20·93 parts of water. It is the peculiar way in which this water is held, its easy expulsion by a moderate heat, and the subsequent readiness of the material to combine with the abstracted water, when again presented to it, and assume the solid state, that give to gypsum its importance in the useful arts, and make its manufacture on the large scale a great and increasing industry.

In its composition will be noted how substances, highly corrosive in themselves, sometimes unite to form inert and harmless compounds. Confectioners largely adulterate their sugar plums with very finely ground or elutriated gypsum.

Gypsum, in the ordinary state, as largely quarried, resembles good limestone or carbonate of lime; but it differs from it in not, when pure, effervescing with acids and in being softer. It is indeed unattacked by acids; but by the action of water it is gradually dissolved and washed away, 1 part requiring 400 parts of water for its solution.

When crude gypsum in any of its forms, except anhydrite, is heated to 212° Fah., it begins to lose its combined water, and parts with it entirely at 272° Fah. If it be now withdrawn from the source of heat and, in a powdered condition, mixed with water, it combines with the same quantity previously expelled, and sets or becomes solid as at first. The operation of driving off this combined water is termed calcination.

We come now to the processes connected with the treatment of gypsum for rendering it available for the arts. The principal treatment, on which everything may be said to depend, is the calcination, or the exposing of the stone to that degree of heat which is just sufficient to expel enough water, so that the powdered material, when mixed with water, will set rapidly into a solid mass. This can be effected in two ways, either by exposing the hard crude stone, in small lumps, to the direct action of flame, or by submitting the crude powdered material to an indirect source of heat. The first method is practiced in Europe, where the crude gypsum is burned in kilns, similar to those used for lime, or sometimes in those of more improved construction, but in which the stone is still exposed to a direct fire.

The disadvantages attending this method are that the lower layers of stone are "dead burnt," so that their powder will not set with water, and the upper layers are apt to be insufficiently dehydrated, giving rise to the same evil. Many pieces of gypsum, moreover, when taken from the kiln, are found to contain a core of raw plaster, which of course is incapable of setting solid. After calcination, the stone found to be sufficiently burnt is powdered and packed for use.

The great demand for calcined plaster, and its cheapness for building purposes, have caused large steam mills to supersede the old-fashioned method of manufacture.

By the kindness of Messrs. Wotherspoon Brothers, proprietors of the Phœnix Plaster Mills, in West Thirteenth street, New York city, our artist has been enabled to make a series of drawings which will help to explain the various processes of the manufacture. The large illustration (Fig. 1) shows the operation of breaking and crushing.

The crude gypsum which, when brought to the mill, is in masses weighing from 20 to 100 lbs. or over, is broken up by the hammer into pieces rather smaller than an ordinary paving stone, and thrown by the workman into the crusher. This consists of an upright shaft expanding below into heavy iron cogs, which turn in an exterior iron shell, as seen in Fig. 1. The stone is here rapidly reduced to powder, but not yet sufficiently fine for the calcining process. A pulley below conducts the powdered material, by means of cleats revolving in an inclined wooden pipe, termed a conveyer, to the floor above. This style of conveyer is used in flour mills, and is located on the left of the crusher in the engraving. Here the crushed plaster is fed by a hopper, like wheat, to a burr stone mill, which reduces it to a fine powder, ready for the calcining process. Another conveyer, similar to the one described, carries the fine raw plaster to a bin at the top of the

Fig. 3.

building, where it is delivered in successive charges to the kettles. These, as shown in the illustration (Fig. 2), consist of large cast iron receptacles, capable of holding 45 barrels as a charge. They are set in brick furnaces and their bot-

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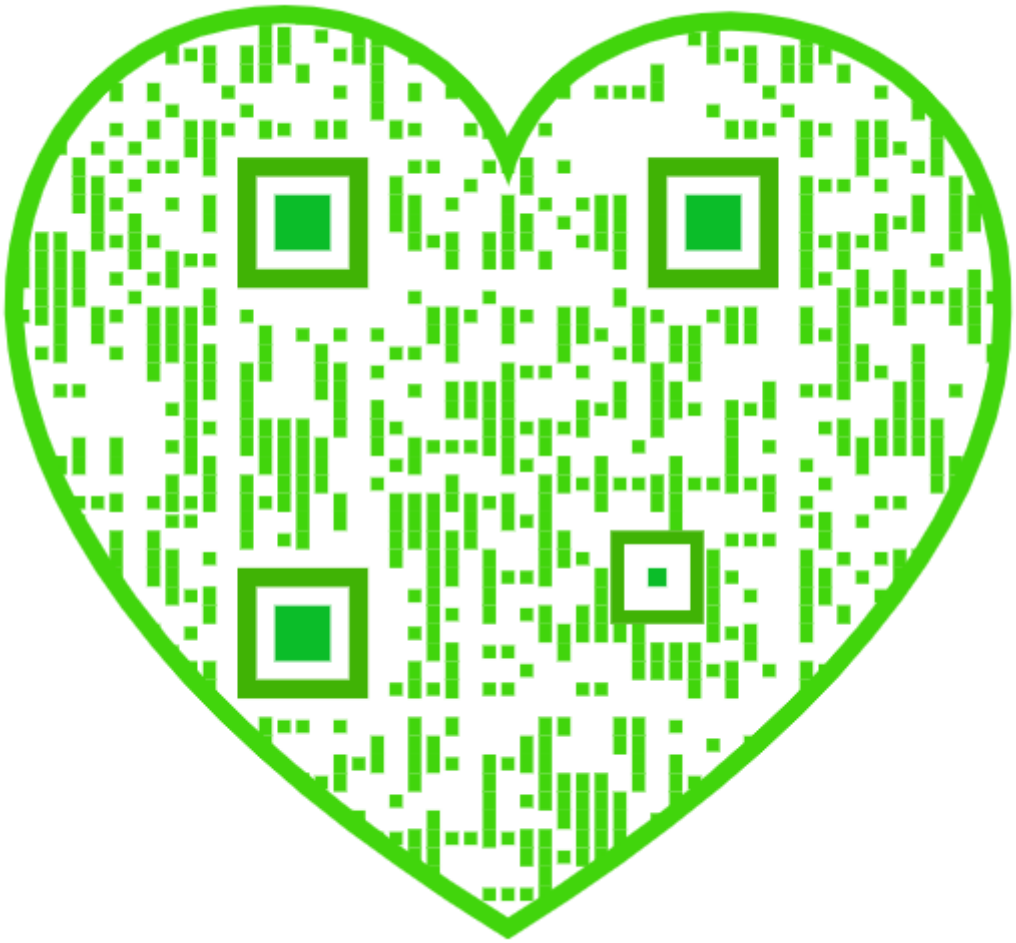

toms are constructed in a peculiar manner and of stout iron, to withstand the heat of an anthracite fire. Revolving stirrers, almost in contact with the bottoms and sides, are kept in motion to prevent caking.

Care and skill are requisite in the calcination process, to avoid either over or under burning. If all the water be driven off, the plaster will not harden so rapidly as that which has been heated so long as the tumultuous expulsion of vapor lasts; and if only half the contained water be expelled, the plaster will have entirely lost its power of hardening with water. Properly calcined gypsum seems to retain one fourth of its combined water. When the calciner judges the process to be complete, the calcined plaster is drawn out into a bin, where it is conducted to the bolt, which is a revolving cylindrical drum made up of three different finenesses of wire cloth set on an incline. The finest sieve is first encountered, and then the material falls upon the others in turn. Directly below, corresponding to the width of each particular fineness of the sieve, are bins which receive the calcined plaster of three degrees of fineness, known as superfine, casting, and common. From these bins the article is rapidly shoveled into barrels and packed for the trade.

The method of packing is seen in the illustration, Fig. 3. The workman first prepares the barrel by lining its interior by hand with a few sheets of brown paper, wide enough to overlap one another. These project above the top of the barrel, and are folded over in a very secure manner, thus answering the purpose of a head. Barrels for distant transportation are headed in the ordinary manner.

The barrel to be filled is first fitted with a wide mouthed funnel, and then placed on a revolving platform, and, while rotating slowly, is tapped rapidly by a hammer actuated by a spring and ratchet wheel. Each shovelful is thus well packed.

This manufactory of the Messrs. Wotherspoon has been in operation over forty years, and utilizes the product of two quarries, one at Wentworth, near Windsor, Nova Scotia, and the other at Hillsboro', New Brunswick. The establishment is capable of turning out about 2,000 barrels per week.

Among the uses of plaster of Paris may be noted its employment for a hard finish to walls and the molding of cornice ornaments, for which purpose, to prevent its too rapid setting, it is usually mixed with a due proportion of slaked lime.

A remarkable fact connected with calcined gypsum is that the addition of two per cent of alum or borax delays its setting three or four hours, but the material then becomes a stone-like body, heavier than ordinary plaster. In Germany, Italy and England, beautiful cements are made in this way, known as parian. In taking casts, and in stereotyping, plaster of Paris is largely used.

Besides its use for molds in potteries, gypsum is employed for glazing porcelain; and, being an excellent non-conductor of heat, for filling fireproof safes. In Spain and France, made into a mortar with sand and quicklime, it is used for cementing floors and vaults.

In the United States, gypsum is extensively used as a fertilizer, and is found to be very efficacious on some soils. It is used as a top dressing for grasses, and for potatoes and turnips, but the grains do not require it. Liebig has pointed out the fact that it fixes the ammonia of the soil as well as that of the atmosphere, thus conveying nitrogen to the roots.

The best gypsum quarries that are worked on this continent are on the Bay of Fundy, Nova Scotia, and Hillsboro', New Brunswick. Over one hundred thousand tuns of the finest quality are annually imported into the United States.

MR. SETH ADAMS, long identified with the commercial and mechanical interests of Boston, died at his residence in Newton a few days ago after a long illness. Mr. Adams was the inventor of the celebrated power press bearing his name, but left it for improvement to his brother Isaac, who afterward became celebrated among printers for his many contrivances for facilitating the art of printing. He had a large property, which was invested in various corporate enterprises.

PUBLISHERS' CARD.

With this issue of our journal, the time for which a large number of our subscribers have prepaid will expire. In order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of the paper to print at the commencement of a new volume, we hope our friends will signify their intention to continue the paper by early remittances.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

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Contents.

(Illustrated articles are marked with an asterisk.)

Agassiz, Professor 401
America and Europe, a new route between..... 404
Answers to correspondents..... 409
Atmospheric railway in London, the..... 404
Business and personal..... 409
Careless plumbing*..... 408
Chinese fresh water fish*..... 407
Chinese mode of catching fish..... 407
Copper spring, a remarkable..... 404
Cuttle fish, huge 402
Dyeing recipes, new..... 405
Eight hour law, the practical aspect of the..... 400
Expansion per horse power, measure of..... 402
Floral decoration, hints for cheap 401
Fountain, the crystal self-acting,* 406
Frigorific effects of capillarity and evaporation..... 408
Gas purifier and mixer 405
Geographical notes, recent..... 408
Hairy men..... 407
Inventions patented in England by Americans..... 408
Iron filings in tea..... 405
Jonah and the Belgian Academy.. 401
Lamp, automatic taper*..... 402
Measuring rod and divider, combined*..... 406
Moistening device for animals*... 406
Mouse, the sea..... 406
Patents, official list of..... 409
Patents, official list of Canadian.. 410
Patents, recent American and foreign..... 408
Plaster of Paris, the manufacture of*..... 399
Preserving zoological specimens. 404
Projectiles, measuring the initial velocity of..... 400
Publishers' card..... 399
Pump, friction geared centrifugal* 402
Railways in Great Britain and the United States..... 404
Scientific and practical information..... 405
Sophora of Japan, the weeping*.. 402
Steel, etc., tempering..... 405
Telegraph code, an easy..... 401
Tower taller than Babel, a..... 402
Toy gymnast*..... 406
Venus, an automaton transit of*.. 403

MEASUREMENT OF THE INITIAL VELOCITY OF PROJECTILES.

The initial velocity of a projectile is its rate of motion through the air, at or near the muzzle of the piece from which it is fired, expressed in feet per second.

The solution of this most interesting problem in the science of gunnery has, of late years, been brought to a surprising degree of simplicity and accuracy by the application of electricity to instruments designed for the purpose. Formerly the problem was solved by determining the quantity of motion of the gun with its charge, etc., suspended as a pendulum, and, afterwards, the results were verified or corrected by receiving the impact of the projectile on a butt, suspended also on a pendulum, and calculating its quantity of motion. Both methods have been employed separately and in conjunction, but they required costly permanent structures, and gave but indifferent results.

The importance of this problem, without a knowledge of which no true estimate of the effects of a projectile can be formed, led to the search for a more accurate solution of it, which has resulted in the production of the electro-ballistic pendulum and chronoscopes now used by the artillery experts of all nations.

Many different instruments have been employed, some of which are still in use and are favorites with the artillerists of different countries. In the United States service, the "Navy," "Bruton," "Vignotte," "Schultz," and "Boulonger" instruments have been and, with the exception of the "Navy," are still used.

All these instruments measure very short intervals of time; some, by means of a falling weight under the influence of gravitation; others, by the oscillation of one or more pendulums of known length; and others, by the isochronism of musical vibrations; and, besides measuring an interval of time, enable us to divide it into fractional parts and record its beginning and end, by means of electricity, either through the influence of electro-magnets, or by the spark from an induction coil.

As a representation of the first class, the Bruton instrument will serve for description. It consists of a graduated semicircle, supported on a tripod vertically, in front of which two pendulums, of equal length, are suspended on journals whose axes are on the same plane. The pendulums oscillate freely, close to the arc. The inner has an arm or marker on its end, which is struck by the outer one as they pass one another. An electro-magnet at each end of the diameter of the semicircle serves to hold the pendulums in a horizontal position, ready for recording. Each magnet is connected with a frame, the first near the muzzle of the piece and the second 100 feet farther on in the path of the projectile. Across each frame, the wire from its respective magnet and battery is passed to and fro, at such distance as will insure its being broken by the projectile in passing through. The battery circuits can be closed and broken at will, by means of a disjunctor.

To test the adjustment of the instrument, the circuits are closed, and the pendulums brought into contact with their respective magnets, where they remain in a horizontal position. The disjunctor is made to break both circuits simultaneously, the magnets become passive, and the pendulums begin their oscillation; they meet or pass one another at the lowest point of the arc, which for convenience is called the zero of the graduation; and at this point a mark is found, near the scale, indicating the place at which they passed. A spring receives each pendulum as it completes a single oscillation and holds it until released for another experiment. The trial thus described having shown that all is in order, the circuits are again closed, the pendulums suspended from their magnets, and the word "fire" is given. The projectile passes through and breaks the first target, and the corresponding magnet releases its pendulum, which begins an oscillation; meanwhile the projectile has advanced to the second target, breaks it, and the corresponding magnet and pendulum are similarly affected. In this case the pendulums, not beginning their oscillations together, do not meet at the zero point of the arc, but some distance to one side of it, where the mark indicates the number of degrees from zero at which they passed. The time of oscillation of the pendulums being known, the short arc enables us to find the time between the fall of the first and second pendulum, which equals the time occupied by the projectiles in passing from the first to the second frame or target; and the space between the targets divided by the interval of time gives the initial velocity. For example, suppose the value of the interval to be one tenth of a second, and the space passed over to be 100 feet, then: $100 \div 0{\cdot}1 = 1{,}000$ feet per second.

The Benton instrument was invented by Major J. G. Benton, of the United States Ordnance Corps. It is probably the best of the pendulum instruments; and, for measuring velocities by means of a single interval of time, is unequaled for general accuracy and ease of manipulation: but a pendulum instrument is limited to this use, and involves sources of error which later ones of different construction are intended to overcome, by discarding the pendulum and adopting a more sensitive agent to indicate the very small intervals of time required.

Prëeminent among these stands the instrument invented by Captain Schultz of the French artillery, and known as the "Schultz chronoscope." It consists of a bed plate on which is mounted a cylinder with clockwork and a screw to give it simultaneously a rotary and lateral motion on its axis; a vibrating fork, whose function it is to trace a scale of time on the surface of the cylinder (which has been previously smoked by the flame of an oil lamp), by means of a quill point attached to one of its arms and resting lightly on the surface of the cylinder, in front of which the fork stands, clamped to the bed plate. The fork is made to vibrate, without fluctuation, by an electro magnet mounted near the end of each of its arms, which alternately attracts and releases them without contact. The electro-magnets are controlled by an "interrupter," which closes and opens their battery circuits as often as the fork vibrates, which is about 500 times per second.

The rotary and lateral motion of the cylinder cause the fork, when at rest, to trace a fine line on its surface from end to end in the form of a helix or spiral, and, when the fork is in vibration, the sinuous line it traces intersects this fine line at the beginning and end of each vibration. The "rate" of the fork is found by connecting a break circuit seconds pendulum with the primary wire of the Rhumkorff coil, whose secondary wire delivers an induction spark on the surface of the cylinder, beside the trace, every second; the number of vibrations between each spark shows the rate of the fork per second, which rate is constant for the same fork.

In like manner the rupture of the target wire (which is in circuit with the primary wire of the coil) by the bullet gives a spark for each, and the number of vibrations traced between the two sparks indicates the time the projectile took to pass from the first to the second target. A micrometer microscope is provided to read fractions of a vibration, and by its use the value of the interval can be determined to within $\frac{1}{50000}$ part of a second.

This instrument is not so easy to manipulate as the one previously described, but it yields more accurate results and is susceptible of more extended use. It will record intervals continuously for 25 or 30 seconds, and so permit of investigating the motion of a projectile through its entire time of flight, and yield data for determining the resistance of the air on its cross section. It has been used to measure the time of passage of a musket bullet over the space of one foot, the average of ten trials being 0·000914." It may also be used to investigate the motion of the projectile within the bore of a gun, an experiment which has been recently made by Captain Noble, of the English service, with a chronoscope of his invention, in which rapidly revolving disks, of almost uniform motion for short periods of time, serve to receive the electric record from the targets.

The *data* furnished by such experiments are of the highest importance in the selection of suitable powder for guns of various calibers and the best forms of projectiles, and the instruments just described are fully equal to the solution of all the problems of modern gunnery lying within their field of research, and may well be expected to hold their prëeminence for many years to come.

THE PRACTICAL ASPECT OF THE EIGHT HOUR LAW.

Supervising Architect A. B. Mullett of the Treasury Department, in his recent annual report, cites various forcible objections to the eight hour system, gleaned from his experience in the employment of labor in the construction of government buildings, since the passage of the act of Congress fixing the above number of hours as a legal day's work. He draws the general conclusion that the practical operation of the law has led to undesirable results.

In brief and generally, it appears that the eight hour system means not merely two hours less toil per day for the workman, but two hours daily practice in habits of idleness with their attendant train of evils; while to the employer and the community at large it indicates a deprivation of useful and valuable labor in a proportion constantly increasing, above its initial limit of twenty per cent, with the length of time the plan is in existence.

Mr. Mullett, in his communication to the department, states the more especial objections to the law, as follows:

"I desire once more to call attention to the eight hour law, believing it to be alike injurious to the best interests of the government and to the workmen themselves. It frequently happens that mechanics and laborers employed by

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the government and those employed by contractors are required to work on the same building, and at the same time. Those employed by the government work but eight hours, while those employed by the contractors work ten hours *per diem*. This causes much feeling, and it needs no argument to prove that it is unjust, and that the mechanic who performs ten hours' work is taxed for the benefit of the more favored workman who has friends and influence sufficient to obtain employment for him on government work. It is also in direct violation of the principle of civil service reform, inasmuch as it converts the employment of mechanics and laborers from a business question of competency and industry to a question of political patronage and personal influence. I do not hesitate to say that it has cost the government millions of dollars, without benefiting the mechanic or laborer in the slightest degree, or, as far as I am advised, any other persons than perambulating or paid agitators, or the claim agents who have instigated litigations and claims for their own benefit. The law has been fairly and fully tested; the experience of this department, as well as of private establishments, has shown that it is not only impossible for a man to perform as much labor in eight hours as in ten, but that he absolutely performs less work per hour under the eight hour system. It is a matter of neither interest nor importance to me whether mechanics and laborers perform eight or ten hours' work, provided the hours of labor are the same on public as on private works. It is, however, impossible to conduct work in a proper manner under a system that increases the compensation of mechanics and laborers employed by the government 20 per cent above market rates, and thus makes them a favored class, without, as I have previously shown, obtaining any advantage therefrom. I would therefore recommend that such modification of the law be obtained as will entitle all persons employed by the government to the highest market rates for their labor, and the benefit of all local rules and regulations in regard to the hours of labor, or otherwise. If this rule is, however, to be the permanent policy of the government, and its mechanics and laborers are to be compensated at the rate of 20 per cent above the highest market rates, I see no reason why officers, clerks, and other employees of the government should not be paid by the same rule. Under the present system, gentlemen of education, who occupy positions of trust and great pecuniary responsibility in the different bureaus, actually receive less than mechanics' wages, and are discriminated against in favor of men who, as a rule, exhibit little interest in the performance of their duties, and have no responsibility whatever. It is also a fact that many mechanics receive, under the present system, not only more than their foremen and master mechanics, but more than the superintendent of the work on which they are engaged, the latter classes being allowed no compensation for extra labor performed."

JONAH AND THE BELGIAN ACADEMY.

Les Mondes devotes four pages to a piously indignant and argumentative editorial on a recent dissension in the Royal Academy of Belgium, regarding the rather antique subject of Jonah and the whale. A member of that institution took occasion, in the course of a paper upon South American travel, to allude to the habits of the dolphin; and in the copy of his remarks submitted for publication, he added a foot note, to the effect that an ancient European legend attributes to these fishes the habit of bringing to land the bodies of drowned persons, which their instinct teaches them to recognize. From this circumstance, says the author, doubtless arose the fable of Jonah. The unlucky word "fable" seems to have set the learned members of the Academy by the ears. Two have resigned, and now an internecine war, aided and abetted by *Les Mondes* and other scientific journals, is raging fiercely.

As we are sufficiently removed from this important controversy to enable us to regard it with dispassionate and philosophical calmness, we may venture, with all humility, to observe that it is utterly immaterial to the progress of modern science whether that whale did or did not swallow the prophet, and that we are unable to perceive why the single member's belief regarding Biblical traditions should so stir up the gall of the *savans* of France and Belgium, to the extent indicated by the elaborate and bitter argument in support of the story published in our contemporary. Has Science grown so poor as not to furnish material enough for profitable discussion, that *Les Mondes* and the Belgian Academy must thus employ their talents in wrangling over a dubious legend of the far past?

HINTS FOR CHEAP FLORAL DECORATION.

The introduction of natural ornaments into our houses is of comparatively recent date. Fashion in her changing moods has willed it, and the conventional and artificial have had their day. Rustic baskets of trailing ivy, stands of gaily tinted growing flowers, mimic ponds teeming with finny life, and vases of autumnal leaves and grasses have replaced the cumbersome china or queer old ornaments of buhl and marqueterie; and even in art, the graceful negligence of nature is imitated in the decoration of our modern dwellings, in showy contrast to the geometrical embellishments and prim finery of the houses of half a century ago. And this is true alike in public as well as in private edifices. One of the recently built theaters, in this city, in place of the meaningless frescoes surrounding its proscenium arch, substitutes huge palm trees with their broad leaves (of tin) drooping from their summits; another fills its lobby with vases of flowers and trailing plants, while a third arranges similar ornaments in conspicuous places in its auditorium, and rumor says a fountain is to be constructed in the center of the parquet

Like all fashionable articles, however, and especially in cities, the question of the expense of such decorations is by no means an unimportant one, and doubtless many of our country readers would stand aghast at the prices demanded by New York florists for baskets of the commonest wild grasses and ferns, even such as flourish in abundance on every brook side. Fifteen dollars is the usual cost of a simple rustic stand, filled, and hanging baskets range from five to ten dollars each. The more elaborate devices, which include bowls of gold fish, or cages of birds, with, perhaps, a few exotic plants, bring sums which are far beyond the reach of ordinary purses. Paying these prices is, however, not at all necessary, if one has a little mechanical ingenuity coupled with a fair share of good taste. We have made beautiful flower baskets from old wooden chopping trays that have survived their turn of usefulness in the kitchen, though perhaps clean new ones would be better. All the materials needed are some sticks of red cedar with the bark on, or, if this variety of wood cannot be obtained, almost any kind can be pressed into service, except ailanthus and kindred sorts, the bark of which peels off bodily; a few bits of rattan, some gnarled roots, a paper of brads, and a little varnish, complete the requirements. A good plan is to cut the cedar sticks into pieces, say three inches long, split them, sharpen both ends, and nail these neatly around and outside the upper edge of the bowl. Then fasten bits of root or twine the rattan around beneath and finish with an irregular knob below. For handles, select three strong pieces of rattan, and secure them firmly to the bowl, letting them extend about two feet above the same and meet in a neat loop. The bowl should not be less than six inches deep, in order to give the roots of the plants plenty of room to grow downward. After the construction of the basket is finished, give it a coat of varnish and the work is done. Dried walnut skins, pine cones, acorns, split butternuts, or even chestnut burrs may be used as ornaments instead of pieces of root. We have also seen some very neat arrangements made entirely of the shells of English walnuts, which had been carefully removed. In filling the basket, first place some broken stone or bits of china at the bottom to serve for drainage, and above add loose earth made of two thirds garden soil and one third sand. As regards plants, unless the basket be large, or a stand (which, by the way, can be made of a soap box, lined with zinc and mounted on feet) be used, we do not believe in any large variety of flowers in a single receptacle. It is nonsense to mix exotics with wild ferns and grasses, because the nature of soil which suits one is generally not beneficial to the other; and very often the warm uniform temperature, necessary for delicate plants, is fatal to the more hardy varieties from the woods and pastures. Fill a basket entirely with English ivy or smilax, and a luxuriant growth can be obtained, particularly if too many shoots be not set in. City florists aim to cram as much as possible into their baskets, and are totally regardless whether the broad leaves of the begonias shade the stems and roots of the more delicate creeping vines. In first setting in the plants, however, place them for a few days in a cold room until new shoots appear. Remember also that plants, and especially ivy, will not grow without light, particularly in the house. Place a pot of ivy, after it has begun growing, for a few days in the shady part of a room, and the young shoots will speedily turn white, while the older leaves will begin to drop off. There is another fact that amateur house gardeners forget, and that is that the roots of a plant need plenty of air; and hence pretty pots of painted china or majolica ware will not answer to contain the earth for their reception. If such vessels be used, the common earthenware pot must be set inside of them, with plenty of intermediate space between; while care should be taken that the higher edges of the outer pot do not shade the base of the plant. Weak vegetation may be rejuvenated with a little ammonia, but it must be used with care, as too much kills. About two drops in a teacupful of water given once a week, we have found to be plenty for a good sized plant, particularly if the earth around the roots be kept loose and not allowed to pack hard.

A very pretty adornment for picture frames is German ivy, a common trailing vine which grows with great luxuriance. All the old medicine phials which infest out of the way closets may be utilized for this purpose. These should be filled with water and hung behind the pictures, and a slip of the ivy inserted. The vine is quite hardy. We have seen a single slip, in a pint bottle, grow until it ran along the entire length of a moderate sized room. In the back volumes of our journal will be found described a host of ingenious ideas of this description. We recently noted a way to raise oak trees in hyacinth glasses, it being merely necessary to suspend the acorn inside and a little above the water. A sponge moistened and with fine seed scattered in its pores, soon becomes a mass of living verdure, though a prettier ornament we think can be made of a large pine burr, similarly prepared and hung, like the acorn, over water. Fine grass seed is the best to use. Wardian cases are very easily made. A shallow box lined with zinc, with some holes on the sides to ventilate the soil, and a large glass shade, easily obtained for a small sum, answer the purpose. The plants take care of themselves, the water which they evaporate condensing on the glass and running back to the soil, so that a species of circulation is constantly maintained. Insect fanciers can combine animal and vegetable life very nicely in one of these cases, as quite an assortment of bugs may be kept alive in them even through the winter. Of course such varieties should be selected as will not feed on the plants.

About as pretty a vine as can be selected for window dressing may be obtained from the ordinary sweet potato. The bulb need only be set in a hyacinth glass, and it will soon send out shoots. Hyacinths look very pretty on a window sill; but in raising them in glass, it should be remembered to keep them in the dark until the roots are two inches long, and also to change the water frequently, never allowing the new supply to be colder than that removed. Dried leaves and vines also make tasteful ornaments if they are properly prepared. Doubtless many have gathered fall leaves, and are waiting for a convenient rainy Saturday to arrange them. To such we may remark that the best plan is, not to use varnish, because the leaves thus treated soon lose their color. Wax is preferable, and is easily laid on with a warm sadiron. Group the leaves in bouquets with plenty of fern, fasten them at the back to a piece of cardboard, and tack them against the wall. We recently gave a description of how very pretty leaf pictures may be made, to which the reader should also refer. German ivy, dried in sprays, looks nicely over pictures in places where the plant will not grow in the bottle or where the living vine is not desired.

AN EASY TELEGRAPH CODE.

The following is suggested as an easily learned code for general use, by which messages of all kinds may be transmitted with certainty, by means of the ordinary electric telegraphic instruments, by means of bells, by whistles, by firearms or cannon, by lights, lanterns, rockets, or flames, by the flash of reflectors, by flags and levers, by the motion of the human limbs, arms, hands, or fingers. It may be written on paper, communicated by touch, drummed on the table, or transmitted by any of the known means of signalizing. It may be employed with facility by the blind, the deaf and dumb; and will enable people who must talk in church to do so without disturbing their neighbors. It may be learned by anybody in five minutes.

The code is formed by dividing the alphabet into five sections, represented by the five vowels, A, E, I, O, U. Everybody can remember the vowels. For the first vowel, A, make one stroke, flash, sound, or motion: for E two strokes, I three strokes, O four strokes, U five strokes. Make the motions for these section letters quickly, but evenly.

For the remaining letters, give the signal for the section letter, as above, and follow with one stroke for each letter belonging to that section until the letter wanted is reached.

THE SCIENTIFIC AMERICAN TELEGRAPHIC CODE.

The Section letters are ☞	A |	E ||	I |||	O ||||	U |||||
	B ||	F |||	J ||||	P |||||	V ||||||
	C |||	G ||||	K |||||	Q ||||||	W |||||||
	D ||||	H |||||	L ||||||	R |||||||	X ||||||||
			M |||||||	S ||||||||	Y |||||||||
			N ||||||||	T |||||||||	Z ||||||||||

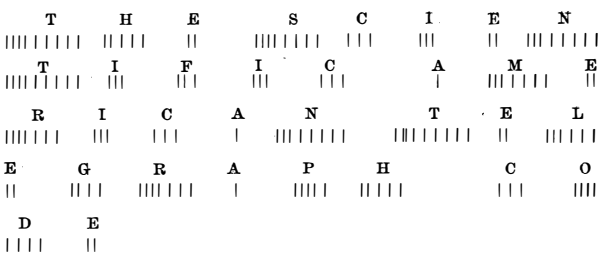
Example: To signalize the letter D, give one stroke for the section letter, A, and follow with three slow strokes, the last being the signal for D.

To signalize L: Give three quick strokes for the section letter I, followed by three slow strokes, the last being the signal for L.

To signalize W: Give five quick strokes for the section letter U, followed by two slow strokes, the last being the signal for W.

The quick strokes are to be made twice as fast as the slow strokes. Practice slowly. Speed will follow accurate practice. After each complete letter signal is given, a space or pause, equal in duration to one quick and one slow stroke, should be made. The space or pause between words is equal to two long strokes.

Example of written message:



NUMERALS, ETC.—To signalize numerals, give two quick double strokes, followed by one slow stroke for each numeral until the figure wanted is reached. Thus:

1 ||||	6 |||||||	Period ||||
2 |||||	7 ||||||||	Attention ||||||
3 ||||||	8 |||||||||	Repeat ||||||||
4 |||||||	9 ||||||||||	Yes |||||
5 ||||||||	0 |||||||||||	No ||||||
		All right ||||||||

This alphabet involves the use of many more signals than the Morse; but it is much more easily learned and remembered than the Morse, or any other that has come under our notice.

DEATH OF PROFESSOR AGASSIZ.

We but reflect the sentiments of the whole country in expressing our deep regret at the news of the death of Professor Louis Agassiz. For nearly a week past the medical bulletins extended no hope of improvement, and it is stated that paralysis had affected the organs of the throat and incidentally almost the entire body. There were fears that, even if life had been spared, the physical system would be so shattered as to render it a total wreck, leaving the patient utterly helpless and condemned to a languishing existence, worse even than death. He died in his sixty-seventh year.

In the deepest sorrow that this terrible affliction has not been averted, we know that every reader of our journal will most cordially join with us. The loss of the man who, above all others, has been universally considered the representative and exponent of American scientific progress, and to the grandeur and vastness of whose mastery over thought and knowledge the world did homage, will indeed be irreparable.

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THE WEEPING SOPHORA OF JAPAN.

As yet we do not know the full value of weeping trees. It is a peculiarity of most weeping trees not to show their full beauty of character till they have attained a considerable age. Who knows anything of a weeping beech who has seen only a young specimen recently planted? Why, it is passed by as a mere curiosity. But give it a generation, and it becomes as picturesque as a gale-tossed ship. So it is with the weeping mountain elm. Some species, it is true, show their beauty from an early age; but the above named marked examples point to the probability that we cannot judge of the effect that will finally be produced by kinds obtained in recent years.

One of the most beautiful of all weeping trees is the weeping form of that fine tree, the Japanese sophora (*sophora japonica pendula*), of which we present an engraving. When well developed, it is attractive in winter or summer. It is more picturesque in outline than the weeping willow, while the shoots hang most gracefully. It is rather a slow grower, its only fault; like the normal form, it would thrive well on dry soils.

As to the position suited for this tree, says *The Garden*, there is no fairer object for isolation in some quiet green bay of the pleasureground or lawn. It should never be crowded up in a plantation or a shrubbery with a number of ordinary trees, which, if they do not rob it at the root, or shade it at the top, will prevent its beauty from being seen.

THE WEEPING SOPHORA OF JAPAN.

Huge Cuttle Fish.

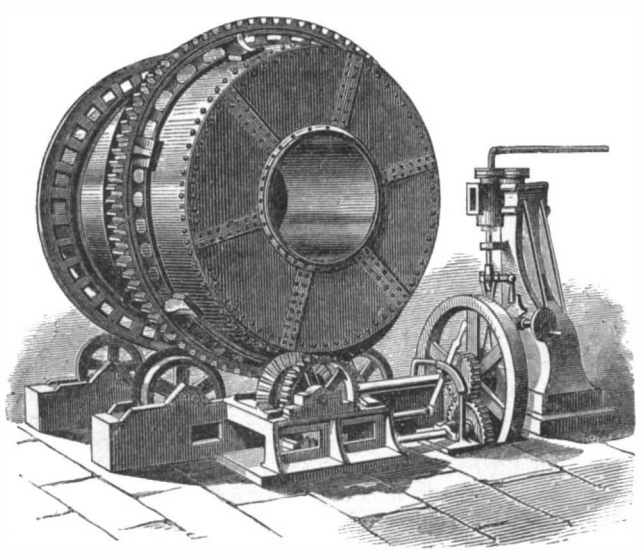
Mr. Harvey, of St. John's, Newfoundland, reports that, on the 26th of October last, two fishermen, who were out in a small boat, observed some object floating on the water at a short distance, which they supposed to be a large sail or the *débris* of a wreck. On reaching it, one of the men struck it with his gaff, when immediately it showed signs of life and reared a parrot-like beak, which they said was as big as a six gallon keg, with which it struck the bottom of the boat violently. It then shot out from about its head two huge, livid arms, and began to twine them around the boat. One of the men seized a small ax and cut off both arms as they lay over the gunwale, whereupon the fish backed off to a considerable distance and ejected an immense quantity of inky fluid, that darkened the water for a great distance around.

The men saw it for a short time afterward, and observed its tail in the air, which they thought to be ten feet across. They estimate the body to have been sixty feet in length and five feet in diameter, of the same shape and color as the common squid, and moving in the same way as the squid, both backward and forward. One of the arms which the men brought ashore was unfortunately destroyed, but a clergyman who saw it assured Mr. Harvey that it was ten inches in diameter and six feet in length. The other arm had six feet of its length cut off before leaving St. John's; the remainder, which measured nineteen feet in length, is but three inches in circumference, except at the extremity, where it broadens like an oar to six inches in circumference.

As usual in the cuttle fish, the under surface of the extremity of the arm is covered with sucking disks, the largest of which are an inch and a quarter in diameter. The men estimated that they left about ten feet of the arm attached to the body of the fish, which would make it about thirty-five feet long.

FRICTION GEARED CENTRIFUGAL PUMP.

We give herewith an engraving of a centrifugal pumping engine, constructed by Messrs. Marquis Brothers, of Glasgow. The engine and pump are fixed on the same bed plate, and are connected by frictional gearing, the fly wheel of the former being grooved around its periphery and gearing into a correspondingly grooved pinion on the pump spindle. The



arrangement is very compact, and provision is made for obtaining ready access to the pump disk by removing a side door with which the casing is fitted. The piston rod, connecting rod, and pump spindle are of steel, and large bearing surfaces are provided. The particular pump shown is intended for use on shipboard for pumping out water, ballast, etc., or for circulating the water in surface condensers in some cases, Measrs. Marquis Brothers substitute ordinary for frictional gearing, while in others, as, for instance, when the lift is low, they connect the engine direct to the pump spindle.—*Science Record* for 1873.

A New Gas Apparatus.

MM. Muller and Eichelbrenner, of Paris, are the inventors of apparatus for producing illuminating gas from coal, etc., which will probably find much favor among gas engineers. Already fifteen gas works in France have adopted it, and it has generally met with much approval. The inventors require no change in the ordinary arrangement of the works, but they do away with the old furnace and replace it by one of considerably smaller dimensions, placed at the back of the bridge, and surmounted by a receptacle of a slightly conical form. This can be filled with coke by its lower door, which is ordinarily kept closed, and its capacity is such that it does not require charging more than once in eight or ten hours. This plan is exceedingly advantageous for small gas works, preventing as it does the necessity of firing during the night.

This furnace is literally a gas producer, the fuel being kept in such a state of combustion, by regulating the admission of the air, that, practically, distillation of the volatile products is carried on. When leaving the furnace, the carbonic oxide and other combustible gases that have been generated enter into a cylinder at the back of the bridge, whence they pass into the oven by a series of openings, distributed over the entire length of the bottom. By means of other openings air can be admitted, which has already been heated during its passage from the external atmosphere, into the apparatus. The amount of air, and consequently of the combustion of the gases that must ensue, is regulated by a register placed on the exterior of the oven. By means of refractory earthenware plates, that can be forced against each of the openings to stop the passage of the gas, the rate of combustion can be more completely regulated, and the temperature of all parts of the oven equalized. This heating of the air, effected by a method already familiar in the heat-economizing furnaces of Siemens, Ponsard, and others, is less complete than theirs, but less expensive in its first construction. According to a report by M. Launy, the ease of working the furnace is great, the expenses generally are much reduced, and the removal of cinders and ash is not required. The principles applied are not new, but MM. Muller and Eichelbrenner have the merit of having combined a variety of conditions of simplicity, efficiency, and economy that had not previously been realized. M. Launy visited the gas works of Montreuil, where one of these new furnaces had been erected alongside one of the old system, and expressed himself surprised at the results just mentioned, and generally gratified with its success.—*Engineering*.

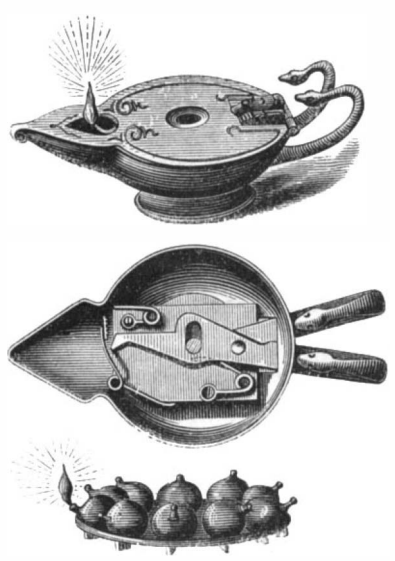
We call our readers' attention to Messrs. Harper Bros. advertisement on the last page of this issue, and to their terms of subscription for their three widely renowned periodicals, which maintain their excellence and their reputation as examples of the highest class of American literature.

What Measure of Expansion will require Least Steam per Horse Power?

We reply to this question that the best measure of expansion lies somewhere between six times and ten times, but it is generally nearer the first limit than the last, and that in fact the gain to be had from working up to a tenfold expansion is so small, as compared to the gain to be had with a sixfold expansion, that it is not worth the trouble. If we were called upon to design an engine of maximum economy—we mean an engine of considerable power and one expected to perform its duties under ordinary conditions—we should not think of adopting a grade of expansion higher than eight times—though we should provide for the earlier cut-off in order to give the governor the control of the engine—and under no circumstances should we permit the terminal pressure to fall lower than 10 pounds above a vacuum. For a tenfold expansion, this contemplates an initial pressure of 100 pounds, and for an eightfold expansion a pressure of 80 pounds absolute, or safety valve loads of 85 pounds and 65 pounds; and it is more than probable that in both cases better results could be had with a sixfold expansion only, giving a terminal pressure, in the first case of 16·6 pounds, and in the second of 13·3 pounds. Having thus stated our opinions, it now becomes our duty to explain why we have formed them. Unfortunately, the whole question is more or less one of opinion from beginning to end. We base those we have expressed on the fact that the entire experience of sea-going engineers and marine engine builders is to the effect that little or nothing is to be gained by expanding steam more than five times. For example, the Elbe, with an expansion of about twelvefold, burns, we believe, about 2·25 pounds of coal per horse per hour; but we have engine room logs in our possession which show a consumption of but 2 pounds, and even less, with a sixfold expansion, or one half that used in the Elbe. Indeed, there is scarcely a well authenticated instance on record where better results have been got with very high measures of expansion than with much larger admissions. On the contrary, very careful and elaborate experiments, carried out in the United States and elsewhere, all demonstrate that measures of expansion much exceeding sixfold give no advantage whatever; and when once this point has been reached, there is a tendency to an increased consumption of steam, which becomes well marked as earlier cuts off are reached, unless the pressure of steam is very high to begin with, as, for example, in Perkins' engines. If any of our readers can cite cases where large measures of expansion did in themselves secure exceptional economy, a statement of the facts will constitute a very interesting contribution to our correspondence columns. It may be urged that in the engine using a high measure of expansion, the economy effected in the use of steam will quite counterbalance this loss, and leave a large margin of profit. Nothing is easier than to prove this—on paper. In practice, however, we believe, nay, we know, that the consumption of steam would be absolutely larger in the more expansive engine than in its rival. This, it is impossible to prove on paper; but our readers may rest assured that it is consonant with experience, and we have no doubt that the proposition will be endorsed by many competent engineers.—*The Engineer*.

THE AUTOMATIC TAPER LAMP.

There has recently been invented, says the *Science Record* for 1873, a taper lamp for the instantaneous production of a flame or light, which is accomplished by simply pressing together the two handles shown in the upper figure of the annexed engraving. The interior mechanism is shown in the figures below. Each tube consists of a little ball of fatty material from which protrudes a short match. These tapers are all set on a rotating plate, under the lamp cover, and are so arranged that, when the handles are pressed together, the plate rotates, and one of the matches rubs against the inside of the case near the spout or opening in the cover, which rubbing or friction ignites the match and communicates fire to the ball, which thereupon burns, producing a light that lasts from five to seven minutes. This is a very curious as well as a useful little example of mechanism.



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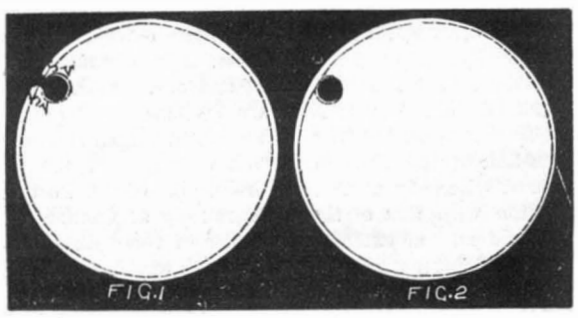
AN AUTOMATON TRANSIT OF VENUS.

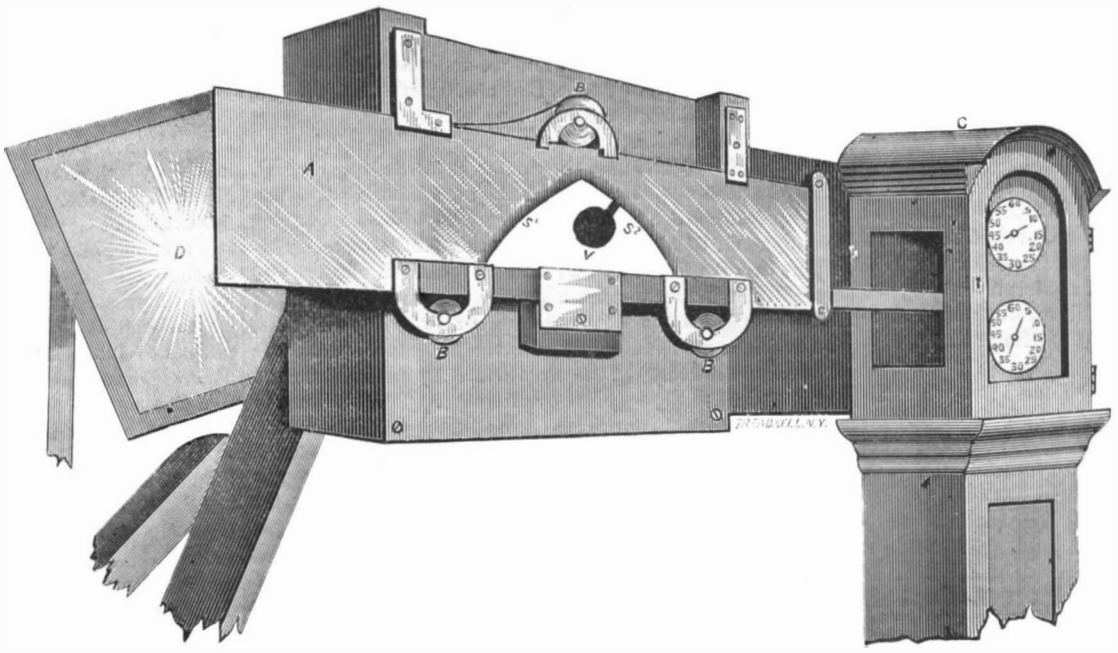
The Astronomer Royal has recently designed and constructed a working model to show the phenomena of the transit of Venus, of a peculiarly complete and simple character, which we show in Fig. 3. A few words only are necessary to enable any of our readers to appreciate its object and scope. A transit of Venus occurs only twice in about 120 years; and hence the importance of observing this phenomenon. The feature to note is the exact instant at which the edges or limbs of Venus and the sun are in contact during the passage of the former across the disk of the latter.

Very great difficulties have been found on the occasion of



previous transits in obtaining reliable observations, owing to the peculiar optical effects accompanying the phenomenon and the consequent difficulty in insuring the observation of the same particular phase in the transit by all observers, as well as the doubt arising from the exact effect of the peculiarities of each telescope and each observer. So great indeed have been these difficulties that the observations of the transits that have hitherto taken place—observations made at great trouble and expense—have been found of very doubtful value. It is, therefore, most important that uniformity in habit of observation should be acquired by all the officers and others leaving England to observe the transit of Venus in 1874. To this end systematic practice of some kind is desirable. How is this to be obtained with a phenomenon occurring only twice in 120 years? Careful observations of the transits of Jupiter's satellites have been recommended, but Sir G. Airy has met the difficulty by a device which appears to give a singularly close copy of the transit of Venus, and on which observers may try their powers to their heart's content. Before giving a description, however, it is well to understand the difficulty to be dealt with in the observation of a transit of Venus. Fig. 1 represents the sun with Venus coming on to it about the moment of internal contact. There is a ligament connecting the black disk of Venus with the sky at the point of contact. This ligament is the main cause of the trouble. It is nearly, if not always, seen, and is explained in the following way:

Any brilliant object dazzles the eye, and by irradiation appears to be larger than it really is; thus, in Figs. 1 and 2, we suppose the real size of the sun to be indicated by the dotted line, while the apparent disk is the size of the larger circle. So again Venus should be seen the size of the small dotted circle, but the sun so far encroaches on her that she only appears to be the size of the black disk whenever her edge is seen against the sun. But up to the moment that the entire edge of Venus enters within that of the sun, the light cannot encroach at the part that, as yet, is not projected against the sun but only against the sky. Consequently, the limb of Venus that last enters on the sun's disk is for a time seen its full size; and the light, as the limb of the sun concealed by it, can neither encroach on the sky nor on Venus. In short, at this point the edges of Venus and the sun are those shown by the dotted circles, and thus the black sky and black disk of Venus meet where the circles, *s s* and *v v*, meet, and thus the ligament is formed. It has been supposed that directly Venus enters within the sun's disk, as shown in Fig. 2, the light rushes in and encroachment takes place. Supposing this to occur immediately after internal contact, it is clear that, when understood, the peculiarity of the phenomenon would greatly facilitate its being accurately observed and recorded. It is clearly necessary, however, to ascertain the truth of this supposition.



AUTOMATON TRANSIT OF VENUS—Fig. 3.

Fig. 3 shows the apparatus designed by Sir G. Airy to represent the transit of Venus, at which the officers and other observers now practise. A glass slide, A A, with a black disk (to represent Venus) fixed on it, is drawn by clockwork across the opening, S_1 S_2, cut in a screen. The curves, S_1 and S_2, correspond to the limbs of the sun at the moments of ingress and egress. By means of the looking glass, D, the reflected beams of the sun are thrown through the opening, S_1 S_2, and the result is that the phenomena of encroachment of light and ligament, or "black drop," is seen in an actual transit. The rate of motion and size of Venus are calculated so as to give the same apparent dimensions and movement when seen on the main building by observers on the top of the magnetic buildings in the Royal Observatory, Greenwich, as those of Venus at the expected transit. The limbs of the sun are brought together and make an arch, in order to give ingress and egress without unnecessary loss of time. We have said that our observers are practising daily at this model, and it may be expected that their personal equations and the effects of peculiarities in telescopes will be clearly established. We may add that some rather unexpected facts have come out, which seem to indicate that a modification of the generally received explanation of the behavior of the black drop, which we have given above, may be necessary. For example, it is found that with a smaller telescope Venus is seen to leave the limb and enter within the sun's disk later, and come in contact again at egress earlier, than with a larger glass. Then, again, it is found that, with a brilliant blaze of sunlight, a ligament is seen in a position when with a faint light it would have disappeared. This is rather contrary to the generally received ideas. It is premature, however, to say much now. A few weeks' work may establish very valuable results.—*The Engineer.*

RECENT GEOGRAPHICAL NOTES.

During the past year, MM. Stuebel and Reiss have explored the Andes of Ecuador, and ascended Mounts Chimborazo, Aetar, Cotopaxi, and Tunguragua. Among the volcanoes of the chain, three exhibit especial characteristics and only one, Pichinchae, retains a moderate activity. We note no especial results of the labors of these explorers, beyond the determination of the altitudes and physical characteristics of the mountain range, and certain trigonometric calculations or observations having for their object the completion of accurate maps of the country.

H. B. M. ship Basilisk has taken possession in the name of the Queen of England of the western coast of New Guinea. This great island is peopled by a long haired black race known as Papous, and is said to be very fertile. The Basilisk explored the coast for a distance of 140 miles and discovered the bay of Youl, to which the name Port Moresby was given. A channel was also found, which, it is believed, will materially improve the route now followed by steamers between the Asiatic and Western American coasts.

There exist in Copenhagen and Moscow remarkable ethnological museums. That in the former city is comprised of forty rooms, in which are exhibited, all the objects and documents relative to the arctic regions. The Moscow museum has sixty wax figures showing the different races existing in the Russian Empire, of which thirty represent types found in European Russia and the Caucasus. The comparison of the contents of the two museums has recently led to a discussion regarding the Ainos, a race now inhabiting the Saghalien Yesso and the Kurile Islands. M. de Quatrefages states that the people once formed a great nation, which extended itself over the Indian Archipelago, conquering the country and founding the present Japanese Empire. The Japanese, however, soon became a distinct race, through intermarriages with the Chinese, and the Ainos gradually disappeared, until only a remnant of the pure stock now exists. They clearly belong to the Caucasian division of mankind, and are also believed to be the progenitors of the Esquimaux of North America.

Dr. Nachtigal, a German traveller, at present engaged in exploring central Africa, has been recently heard from. He has traversed the shores of Lakes Tchad and Chosi, and arrived at a capital city called Abon-Cheu. The inhabitants are violent, quarrelsome, and intemperate, hating strangers, and only ruled by the tyrannical power of their sultan. The commerce consists in slaves, ivory, and ostrich feathers, and flows mainly to Egypt.

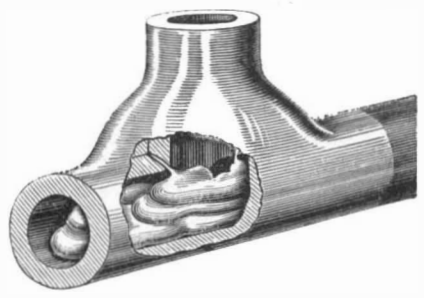
M. Delesse announces the discovery of new silver mines at Caracol, near the frontiers of Chili and Bolivia. Sulphides and sulphates of silver are found associated with argentiferous lead. The mines were found by Frenchmen, and a capital of thirteen million dollars is to be raised for their exploration.

J. W. writes that 400 men were killed in the State of New York, in seven months, while coupling cars.

CARELESS PLUMBING.

We should advise such of our readers as are plumbers to cut out the accompanying little engraving and post it in a conspicuous place in their shops, so that all their journeymen may have it constantly before their eyes. It indicates about as disgraceful a botch as any mechanic who pretends to the smallest degree of intelligence could hope to accomplish.

The piece of piping represented was recently removed from a building, situated in this city and owned by a gentleman with whom we are well acquainted. For some time past, continual complaints have been made by tenants of a



failure in the proper water supply. An experienced mechanic was set to work to discover the trouble. After exhausting his ingenuity in trying to remedy the defect, he finally concluded that the main pipe was too small, so a larger connection was laid at great expense; still the difficulty continued. It was finally determined to cut away the joints of the conduits through the building. This was partially done, when the piece shown in our engraving was removed, and the cause of the trouble at once made apparent. The individual who mismade the joint (we cannot do violence to our feelings by calling him a plumber) carelessly fitted the connection to the larger pipe, and by so doing allowed his solder to fall into the bore of the latter, choking it up almost completely. The fragment is now before us; and estimating the pipe to be about ⅝ inch originally in internal diameter, it is evident that the solder has reduced it to an opening of probably barely a tenth of an inch.

It occurred to us that doubtless many of our readers are experiencing difficulty with the water arrangements of their buildings, and vainly seeking just such a hidden cause as this; hence we have had the annexed engraving made in the hope that it may serve as a suggestion of value. In any event, it will do for a warning to plumbers to be careful in soldering pipe joints.

A Tower Taller than Babel.

Messrs. Clarke, Reeves & Co., proprietors of the Phœnixville Bridge Works, Philadelphia, Pa., propose to construct a wrought iron tower, one thousand feet in hight, to be completed for the American Centennial Exhibition in 1876. The tower is to be circular in section, one hundred and fifty feet in diameter at the base, diminishing to thirty feet at the top. It is proposed to have spiral staircases winding around the center tube for those preferring to walk up; but elevators will be provided, which are calculated to ascend to the top in three minutes. We have in process of engraving a full page illustration, representing the tower in contrast with St. Peter's Cathedral, Rome, St. Paul's Cathedral, London, Bunker Hill Monument, the Pyramids of Egypt, and other existing tall structures, all of which, alongside of the thousand feet tower, look like pigmies.

This is one of the greatest engineering projects of the age, and it is in the hands of constructors capable of completing whatever they undertake. The beautiful engraving we are having executed will be ready for publication in the SCIENTIFIC AMERICAN within about two weeks. We calculate that it shall be the handsomest wood engraving that has appeared in any American newspaper. The copy of paper containing this engraving will be worth a whole year's subscription.

Frigorific Effects of Capillarity and Evaporation.

By directing upon a sheet of spongy paper, wet with bisulphide of carbon, a spray of pure water, hoar frost is not formed; but if the conditions be reversed, and the bisulphide applied in a finely divided spray, (according to M. Décharme) a circle of arborescence becomes quickly apparent. The same jet, directed on the bulb of a thermometer, produces first hoar frost and then arborescence, together with a lowering of temperature from +50° to —7° Fah. Arborescence thus formed upon a glass plate may be retained long enough for examination by the microscope. Other liquids which are capable of producing similar effects to bisulphide upon spongy paper are chloroform and rectified sulphuric and bromhydric ethers. The icy arborescence is believed to be purely aqueous. Its point of fusion corresponds exactly with 0° C. (32° Fah.), and it has no taste or odor after the evaporation of the volatile liquid with which it is impregnated.

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Correspondence.

A New Route between America and Europe.

To the Editor of the Scientific American:

On page 294 of your current volume, I notice a proposed new route between New York and London. This route, I think, was first proposed by Sandford Fleming, C. E, when he conducted the preliminary survey for the Intercolonial Railway, about six years ago; and it was specially made on behalf of the upper provinces of the Dominion, and before the line was constructed from Bangor to St. John. I question whether Mr. Fleming now entertains the project. As a line from New York, it cannot compare with that which is hereinafter proposed. Although Shippegan is counted an excellent summer harbor, its value for such a purpose would be greatly reduced by the fact that it is only open about eight or nine months in the year. Then it would require to be connected with Bathurst with a branch of nearly fifty miles in length, which will not probably be soon constructed.

If the people of the United States wish to see the ocean traveling between the two continents reduced to a minimum, they can safely reckon on the lines of railway already constructed *viâ* Bangor, Vanceboro', St. John, Sussex, Moncton, Amherst, etc., to Truro, and thence by branch to Pictou, instead of going to Halifax. From Pictou a line is contemplated to Whitehaven, or some other suitable port near the Strait of Canso, which would materially shorten the ocean voyage; or it would be better still to tunnel the Strait of Canso (this is believed to be quite practicable where it does not exceed a mile and a half in width), thence by railway (to be constructed) to Louisburg, a port said to be open all the year round, near the eastern extremity of Cape Breton and more than 200 miles nearer Europe than Halifax. Now Louisburg is much nearer St. George's Harbor than Shippegan, without being so far back in the cold; and with this connection by steamer, and a railway thence, say 250 miles, to St. John's, the great object would be accomplished. Perhaps a further improvement in this line could be secured. Should Aspy Bay, or some other point in the vicinity, prove to be a good ocean terminus for the railway, it would still further shorten the passage by water to Newfoundland. And this is the direction in which improvements should be looked for in the line of travel between New York and Europe. The tunneling of the Strait of Canso need not be regarded as a very formidable affair, after what has been accomplished at Mount Cenis and the Hoosac. The only other break in the proposed continuous line of railway would be at St. John's, where a good suspension bridge of 620 feet span, for ordinary traveling, now crosses the river. There a suitable structure for railway purposes is only a question of time.

Petitcodiac, N. B. GEO. W. MCCREADY.

Preserving Zoological Specimens from Insects.

To the Editor of the Scientific American:

The difficulty of preserving zoölogical specimens from the depredations of insects is a matter of regret and anxiety to every collector, and various methods have been proposed for accomplishing this desirable object. The compositions into which arsenic and corrosive sublimate enter are well known to be very effectual when properly applied; but unless used with caution, they are apt to injure the natural pliancy of the skins, and are hardly effectual in protecting collections of insects. I have known these substances, even in the hands of the most expert, to produce such tenderness of the skins as to form a considerable obstacle in setting up specimens. To render them effectual they must be carefully applied to each specimen, by which the labor of collecting and preserving is considerably increased.

Every substance which I have tried seems inferior in efficacy and ease of application to the rectified oil of turpentine, and my method of using it is as follows: I put the turpentine in a bladder, the mouth of which is firmly tied with a waxed string; and nothing more is necessary than to place the bladder thus prepared in the box with the birds, or to tie it to the pedestal on which the birds are perched in a case. If there be any maggots on the birds, I have invariably found that they will soon be dislodged from the feathers, fall to the bottom of the case, and die in the course of two days. I have also made the experiment of introducing the common house fly, the large blue bottle fly, and moths into a case of birds so defended, through a small hole in the bottom of the case. The moment the flies enter the box they begin to vomit a whitish, glutinous matter, they are much agitated, and the largest of them dies in a few minutes. I have repeatedly introduced, in like manner, active cockroaches; and these strong insects soon became uneasy, often rubbed their sides with their hind feet, and usually died in about an hour and a half. I next got a bird skin full of living maggots and placed it in my defended case; in about three hours, they were seen coming out in all directions, and fell to the bottom of the case, where they died. For large cases of birds, a pig's or sheep's bladder is sufficient. The turpentine evidently penetrates through the bladder, as it fills the case with its strong smell.

New York city. G. W. B.

A Remarkable Copper Spring.

To the Editor of the Scientific American:

Inclosed you will find a nickel five cent piece that was coated with copper, as you see it, by a spring in Monroe county, Tenn., in what is known as the Coker Creek gold region. I was traveling through the mountain regions of North Carolina and Tennessee this fall, and had heard a great deal of talk about the rich mineral resources of that part of the country, and had a great curiosityto visit it; and I was astonished to find such rich indications in the way of gold and copper. The spring which coated this coin with copper is a great curiosity; it ebbs and flows every twenty-four hours. In the evening it scarcely runs at all, but in the morning it runs quite briskly, and all around its border you can pick up small pieces of blue stone. There are also rich specimens of quartz in the same range. The spring is situated between the Chilhowe and Uanachacha mountains, about three miles from the North Carolina line, and about eighteen miles from the celebrated Duck Town copper mines. I was told that an English miner had been to look at it, and had offered fifty thousand dollars for the lot to one of the partners who owned it; but he went to Europe, and on his return he learned of his death, and did not know where the other partner lived. It is astonishing that such valuable mineral wealth should lie undeveloped when, by a little energy and capital, there could be made a large profit on the investment of time, labor, and money. JOS. YOUNG.

[REMARKS BY THE EDITOR.—The specimen sent by our correspondent consists of a nickel five cent coin, thickly covered with a deposit of copper.]

THE ATMOSPHERIC RAILWAY IN LONDON.

In addition to thirteen miles of three inch bore pneumatic tubes, for sending telegraph messages between various stations, there is also in operation in that city a line of pneumatic railway, the capacity and operation whereof we find described as follows in a recent number of the London *Times:*

The pneumatic tube extends from the London and North Western Railway station at Euston square to the General Post Office in St. Martin's-le-Grand. The central station is in Holborn, where is also the machinery for effecting the transit of the trains. Here the tube is divided, so that in effect there are two tubes opening into the station, one from Euston to Holborn, and the other from the Post Office. The length of the tube between Holborn and Euston is 3,080 yards, or exactly a mile and three quarters, a greater length than was originally contemplated, but which was rendered necessary by the avoidance of certain property on the route. The tube is of a flattened horseshoe section, 5 feet wide and 4 feet 6 inches high at the center, having a sectional area of 17 square feet. The straight portions of the line are formed of a cast iron tube, the curved lengths being constructed in brickwork, with a facing of cement. The gradients are easy; the two chief are 1 in 45 and 1 in 60, some portions on the line being on the level; the sharpest curve is that near the Holborn station, which is 70 feet radius. The tube between Holborn and the Post Office is 1,658 yards in length, or 102 yards less than a mile, and is of the same section, and similarly constructed to the first length. The gradients of 1 in 15 occur on the Post Office section, but this steep inclination is in no way inimical to the working of the system.

The wagons, or carriers, as they are termed, weigh 22 cwt., are 10 feet 4 inches in length, and have a transverse contour conforming to that of the tube. They are, however, of a slightly smaller area than the tube itself, the difference —about an inch all round—being occupied by a flange of india rubber, which causes the carrier to fit the tube exactly, and so to form a piston upon which the air acts. The machinery for propelling the carriers consists of a steam engine having a pair of 24 inch cylinders with 20 inch stroke. This engine drives a fan 22 feet 6 inches in diameter, and the two are geared together in such a manner that one revolution of the former gives two of the latter, or, in technical terms, the engine is geared at 2 to 1 with the fan. The trains are drawn from Euston and the Post Office by exhaustion, and are propelled to those points by pressure. The working of the fan, however, is not reversed to suit these constantly varying conditions; it works continuously, the alternate action of pressure and exhaustion being governed by valves. The engine takes steam from three Cornish boilers, each 30 feet long and 6 feet 6 inches in diameter. Telegraphic signaling is carried on between the three stations by means of needle instruments.

The experimental working of the tube has already formed the subject of careful investigation with several engineers, whose opinions are highly favorable to the system. In the early part of 1872, Mr. W. H. Barlow, the consulting engineer to the Midland Railway Company, instituted a series of experiments with the pneumatic tube, which extended over several days. The results thus obtained led Mr. Barlow to the conclusion that the greatest working economy of the pneumatic tube was obtained in moving a great amount of weight at low speeds. In other words, with the same number of revolutions per minute of the engine and the same pressure, a very large increase made in the load produced a comparatively small decrease in the speed. In the Post Office section of the tube two gradients of 1 in 15 occur; but notwithstanding this, the heaviest loads were those which produced the best commercial results. Mr. Barlow's experiments showed that 20 tuns of goods were conveyed through the Euston tube in 8 minutes, and 12 tuns through the Post Office tube in 4½ minutes. Hence, with the engine working on each tube separately, two trains of 12 tuns each might be brought through the latter tube in 9 minutes, and might be sent forward in one train of 24 tuns to Euston in about an equal space of time. That is to say, 24 tuns of goods might be conveyed through the entire length of the tube in 18 minutes, or, allowing a delay of six minutes at the station for shifting the trucks from one line to the other, the practical result would be the transport of one tun of gross load per minute.

The practical conclusions to which the preceding remarks point are that there exists at the present time, in good working order, a rapid and efficient means of transit for parcels between one of our leading railways and the Post Office, with an intermediate station. The system is now open to the public for the conveyance of goods, and the public are availing themselves of the benefit it confers. The comparatively limited extent of the district served means, of course, for the present, proportionately limited commercial results. It remains, however, for the Pneumatic Company to prove the soundness of their scheme by regular systematic working, and so to gain the confidence of the Postal authorities and the railway companies, to whom the pneumatic tube should prove a great boon. Useful as the system is as at present arranged, it requires but slight extensions to very materially increase that usefulness. It has already one of its termini at the Euston Station, and the proximity of the Midland and the Great Northern Stations at once suggests short extensions to both of those points. Again, the relative position of the Holborn Station with that of the South Eastern Railway at Charing Cross, and of the Post Office station with that of the same railway at Cannon street, would render an extension in either of these directions no very difficult matter, while all parties would apparently be benefited by the result. Then there are the district offices of the postal system, most of which might be placed in direct communication with the chief office by means of the pneumatic tubes, in the same way that, to some extent and by means of small tubes, the postal telegraph offices are connected at present time. Should the satisfactory results of of experimental working be borne out by the practical trial the system is now undergoing, there appears to be no reason why it should not be generally extended to all parts of the metropolis and the suburban districts.

Railways in Great Britain and the United States.

The recent financial panic in the United States has naturally directed much attention to the railway system, which has been accused as the cause of all the disasters. It is not within our province to enter within the mere financial question, except so far as engineering enterprise may bear on it. The object of this article is chiefly to examine into the statistical history of the system, compared with our own, in regard to construction, population, commerce, etc., and thus to give prominence to certain facts which, so far as we know, have not hitherto been placed in such a position for the professional and general reader.

In 1830, there were but some 23 miles of railway existing in the United States; and at the end of 1872, there were 67,000 miles in existence.

In 1870-72 nearly 20,000 miles were constructed, or considerably more than the whole railway mileage of the United Kingdom at the present day.

The above statistics bear a striking contrast in rapidity of progress when compared with the extension of the British railway system. For example, in 1842 we had but 1857 miles; and in 1870 we had 15,540 miles, nearly. Between the end of 1864 and the end of 1872, the increase in the United States lines was about 33,000 miles, or just about double the total of British railways existing at the end of 1870. In other words, American enterprise had constructed, in eight years, double the mileage that we have effected in about forty years.

Next comes the question of the comparative cost of the two systems, and this is one of great importance in an engineering point of view. We are as nearly correct as we can be in stating that, while our 15,540 miles of railway involved by the end of 1870 a capital of $2,650,000,000, the 67,000 miles of United States railway cost only $3,150,000,000. The ratio of mileage is as 1 to 4·31; it consequently follows that, if the cost of the United States lines had been per mile the same as ours, the capital they would have involved would have amounted to $11,421,500,000. Taking the subject in another point of view, we shall find that, if the cost of our lines had been in the same ratio as that of the American lines, our expenditure would only have been some $730,000,000. Taking the cost per mile, the United States lines average 47,000, and here the contrast with us is very great. The cheapest constructed line in this kingdom is the Highland, which cost $61,300; the average is about $ 180,000 per mile. This would have confirmed our previous estimate of the cost as being over four times that of the United States, had we included shorter but more expensive lines in the United Kingdom. These figures have certainly a startling appearance, and this is increased if we take into consideration the difference of dividend that would have accrued to British shareholders had it been possible for the English lines to have been so cheaply constructed; but in considering this matter, the far larger proportion of single lines in the United States must be born in mind, while it must be remembered that the station buildings and general fixed plants of a large proportion of the cheaper American lines are such as would be quite incompatible with the traffic to be accommodated here.

In respect to the engineering department, the advantages the Americans possess are very great in the majority of cases. Stone and iron for solid work, and brick where it is easily procured, are the sole materials employed by us. In America, on the contrary, wood, which can be obtained at a much lower rate, was at first almost universally employed for bridges, stations, and other constructions. Another point of great importance is the fact that, while the great majority of American railways are only single lines, ours, with scarcely an exception, are double lines and now triple lines, as on the London and North Western, are becoming common where great traffic exists. The cost of earthwork of all kinds, bridges, etc., increases greatly with the increased

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width, and the cost of the single lines would be much less, even if labor and material were at the same price in each case. Practically, the United States traffic is moderate, and spread over a large area of line, while ours is enormous, and spread over a very limited area. Hence, with us solidity and durability are of absolute importance, qualities which, as a rule, do not distinguish American railway construction.

Sleepers are an item of serious cost also with us; and the geological structure of our islands is such that cuttings, embankments, and tunnels are of constant occurrence, a level piece of line, except in the east of England, being of very rare occurrence. In the United States, on the contrary, the contracted contour of our country becomes expanded. Level plains are of enormous extent; and if there are obstacles, such as hills and mountains, the cheapness of land and construction permits a *détour* which would be simply ruinous, if not impossible, with us.

An interesting question, and one of great importance, as effecting railway enterprise, is that involving area, population, and commerce; and in this the comparisons between the United States and ourselves is remarkable. In 1861 our population was 29,321,288; in 1860, that of the United States was 31,443,321. In 1871, ours was 31,817,108, and that of the States in 1870 was 38,555,983. The latter, therefore, increased by seven millions, while our increase in the same period was about two and a half millions; the American increase was thus nearly three times that of ours. Comparing the respective areas, ours is 121,115 square miles against 3,034,459 of the States (exclusive of Alaska), of which about one fourth only is under civilization; but this area is six times that of ours, say 750,000 square miles. Our ratio per square mile is 250 persons against about 51 on the limited area just estimated. It results that, while both goods and passenger traffic is carried on in a compact area with us, the reverse occurs in the States. If precisely the same traffic took place for an equal population, at the same cost of material, wear and tear, etc., in both countries, it is evident that the States lines would be ruinously expensive. But fortunately for them the general cost of management and repairs is much less.

The management of the United States railways has been a subject of much complaint, and blame has been cast alike on engineers, directors, and other officers of the companies. We are not disposed to dip our hands into dirty water, of which abundance has been scattered about lately.

On the other hand, however, the resources of the country are enormous. Generally the soil is of inexhaustible fertility for the growth of corn, cotton, tobacco, etc. The forest districts afford endless supplies of almost every kind of useful and ornamental woods. In the mineral kingdom few valuable products are absent; coal, iron, copper, lead and most metals being found in abundance and frequently of the richest ores. All these natural products will tend to foster railway enterprise; and if this, in future, be restricted in its extension to the actual wants of the country, instead of its supposed distant necessities, it is impossible but that railway enterprise in the States can be other than of the most profitable and prosperous character at no distant period.—*Engineering.*

Gas Purifier and Mixer.

M. D. Colladon says: Gas requires to be freed from particles of solid matter, naphthalin, coal tar, ammoniacal salts, etc., as well as from gases such as carbonic and sulphurous acids. For washing it, vessels have been employed similar to Woolf's bottle, in which the gas traverses water or a suitable solution through a metallic network, in the form of bubbles or continuous currents. This arrangement is insufficient for working on a large scale; because the bubbles of gas take a spherical form, and consequently present a minimum of surface for a maximum volume.

Further, this method requires a decided increase of pressure, which is inconvenient. The chemical cascades, in which the gas passes upwards through a fine rain of the washing liquid, act much better, but they require too large a quantity of liquid. Coke towers (scrubbers) produce a more complete effect, but the action is very irregular. The new mechanical washing apparatus has the advantage of producing very powerful action without requiring large dimensions. At Geneva it yields coal gas, superior both in illuminating power and in a sanitary point of view. Less purifying matter is also required than on the old system. The same apparatus will doubtless prove useful when it is required to saturate a gas with the vapors of a liquid, for example, hydrogen with the vapor of petroleum. The system rests on the principle that the best arrangement either for washing a gas or saturating it consists in making it strike, in the form of currents as thin as possible, against solid walls kept perpetually moist. The currents are broken against these surfaces, and are prevented from moving on in a straight line. The gaseous particles are thus always kept in a rotatory movement, and are pressed against the moist walls, so that they either absorb the substance diffused over these walls or may deposit there a part of their own substances, according as it is required to saturate the gas or to wash it.—*Chemical News.—Comptes Rendus.*

New Method of Tempering Steel and Regenerating Burnt Iron.

M. H. Caron says: A piece of steel is generally tempered, and then reheated more or less according to the hardness nd the elasticity which it requires to receive. The dry temper, as commonly practiced, that is to say, plunging the red hot metal into cold water, has the drawback of developing cracks and crevices injurious to its tenacity. Reheating does not remove these flaws; and subsequently, on use, these fissures, though invisible at first, increase and terminate in fractures. It has already been discovered that, in order to escape danger, it is preferable to temper the steel a little softer and afterwards to reheat more slightly. The author has succeeded in producing the combined effects of temper and reheating in one operation, and of removing as far as possible the chances of flaws. This is done by heating the water, into which the red hot metal is plunged, to 55°. Tempering in hot, or even boiling, water modifies soft steel containing from two to four thousandths of carbon. This process augments its tenacity and elasticity without sensibly altering its softness. The texture is changed and becomes fiberous, even if previously crystaline. The author's method for restoring burnt metal is likewise to plunge it at a red heat into a hot liquid.—*Ibid.*

New Dyeing Recipes.

[Reimann's Färber Zeitung.]

This number contains a recipe for a safflower rose on glazed calico. The dressing consists of 50 lbs. of wheat starch, 20 lbs. of wheat flower, 4 lbs. of white wax, and 6 lbs. of cocoa nut oil, a little sulphuric acid being added to the water in which the starch is mixed.

There are also recipes for light and deep Prussian blues on glazed calico; for a green (extracts of indigo and of quercitron) on jaconnet; a peach wood crimson on glazed calico and jaconnet; a brown on calico with Bismark brown and magenta; a gray drab on wool, and a scarlet on woolen cloth and flannel; also a blue (soluble aniline blue) and a coffee brown on plush; a violet on woolen yarn. The mordant in this case consists of 1½ ozs. of tannic acid, dissolved in hot water in which ½ oz. of Marseilles soap is next dissolved; ½ oz. rape oil is next added, and stirred up till it forms an emulsion. The liquid is used at 167° Fah. The bleached yarn is worked in this mordant for fifteen minutes, and then withdrawn. The color bath, at the same temperature, is prepared with 5 ozs. of alum and the clear solution of 1 oz. of methyl violet.

There is also a prescription for a light green on cotton yarn, the color being methyl green fixed with tannic acid.

The editor gives a recipe for a brown on shoddy containing a mixture of cotton, called on the continent *velour*. To 100 lbs. of this material, make up a bath of 30 lbs. of fustic, 3 lbs. of alum, 2 lbs. of prepared tartar, and 1 lb. of blue vitriol, in which the shoddy is boiled for half an hour. To the same flot are then added 1 lb. of chromate of potash and ¾ lb. of aniline red, ruby, or aniline crimson, known on the continent as rosain. The dyeing is carried on at a gentle boil, and turmeric added to modify the shade. Logwood may be used, if needful, to darken. Aniline is refuse magenta; it is dissolved in hydrochloric acid and boiled in water previous to use.—*Chemical News.*

Alleged Presence of Iron Filings in Tea.

In several cases of prosecution under the adulteration act which have recently been reported, the analyst has been able to demonstrate that a magnet thrust into a specimen of tea would attract certain particles which were stated to be iron filings, and held to be indisputable proof of a fraudulent admixture. That this inference is necessarily correct has, however, been disputed in more than one quarter. Mr. Treffry, of Exeter, England, writing to the *Grocer*, asserts that the mineral matter found in tea is not iron filings but a native magnetic oxide of iron, and he states that "it is probably titaniferous iron sand, which is very abundant in China." Mr. Alfred Bird, F. C. S., of Birmingham, says that he has separated particles of mica and quartz from the magnetic oxide of iron found in tea, his inference being "that, as magnetic oxide of iron forms part of the soil of China, it would rise with the dust of the country, and coming in contact with the damp leaves would adhere to them when they are dried, and thus make the dried leaves stick to the magnet as if there were iron filings mixed up amongst them." Speculative, to say the least, as this may seem, it would appear to receive some support from an experiment made by Mr. Bird upon some French bean leaves grown in his own garden. One hundred grains were dried, and upon testing with a magnet were found to be attracted by it in a similar manner to that reported of some specimens of tea leaves. A closer examination of the matter adhering to the leaves showed that it was magnetic oxide of iron, and 0·02 of a grain was obtained from the 100 grains of bean leaves. An investigation of the black mold of the garden in which the plants were grown showed that it contained an abundance of magnetic oxide of iron.

If all that the opponents of the adulteration act say against it were true, it would be but little to be able to reply that it is not an unmitigated evil; but still it is a fact that the act has given a great impulse to the investigation of food substances, the benefit of which must appear in an acquisition to our store of knowledge respecting this important subject. For even should Mr. Bird's speculations prove correct, it would not be the only instance that has recently come under our notice where the presence of a gross adulterant has been alleged upon insufficient grounds.—*Pharmaceutical Journal.*

DENTIST'S SOLDERS.—I. H. P. says: For gold solder, use 8 grains American silver coin and 4 grains best copper wire (or copper from an old style cent) to each pennyweight of gold plate of the same fineness as that to be soldered. For silver solder, use 8 grains best brass wire to each pennyweight of silver coin. Melt with borax, cool, and roll into plate.

THE Hoosac tunnel alignment proves to have been very accurately made. The error in vertical alignment was only nine sixteenths of an inch, and that in the level was one inch and a half. This result is very creditable to the engineers.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW WEATHER VANE.

The old weathercock has three essential faults; it indicates a direction when there is a dead calm, it gives no means of learning the force of the wind, while it fails to show the true course of the same, by exhibiting merely its horizontal component. M. Tany proposes the arrangement to be attached to the ordinary lightning rod. Just above a suitable shoulder on the latter is placed a copper ring, grooved and made into a pulley easily rotated in a horizontal plane. Around this passes a knotted cord, the ends of which are secured to the extremities of a short stick or metal rod, to which is secured a simple streamer. Thus constructed, the vane indicates a calm by falling vertically, and besides shows the strength of the wind by being blown out more or less from the lightning rod. As is evident, it is capable of motion in every direction, so that if there exist in the wind an upward tending vertical component, the same will be shown.

NEW MODE OF SHOWING NODAL POINTS IN SOUNDING TUBES.

Bourbouze proposes, as an improvement upon the Kœnig capsule generally used for the above purpose, the employment of a simple membrane of rubber on which is attached a very light silvered mirror which oscillates with it. If rays from a luminous point be reflected upon the mirror, and the image passed through a lens, the image is lengthened, and often transforms itself into an ellipse. It reaches its maximum elongation when the mirror is placed at a node, but retains its immobility when reaching the points corresponding to ventral segments. The device, it is stated, can be placed at the extremities of Helmholtz's resonators, or of the rubber tube attached to these instruments, and the mirror vibrates when a mixed sound is produced, containing the note proper to the resonators, to which it is applied.

AQUEOUS EXHALATION OF PLANTS.

M. Barthélemy, after a series of experiments on the above subject, concludes that in plants there is an insensible exhalation throughout the entire cuticular surface, through the medium of a true gaseous dialysis; that there is an abrupt emission of saturated gases which escape by breathing apertures when the plant is submitted to a rapid elevation of temperature, especially when under a bell glass; and that there is finally an accidental exudation, the result of defects in equilibrium between the absorbent action of the roots and the work in the aerial portions for the fixing of the carbon added to the elements of the water, a labor which ceases when light disappears.

SIMPLE METHOD OF DETECTING ADULTERATION OF WINE.

Into a small quantity of the wine to be tested, says *Le Temps*, drop a piece of potash. If no deposit is formed, and the wine assumes a greenish tint, it has not been artificially colored. If, however, a violet deposit appears, elder or mulberries have been used. If the deposit be red, the adulteration is sugar beet; if violet red, campeachy wood; if violet blue, privet berries; if clear blue, coloring matter obtained from sun flowers.

IMPROVEMENT IN PHOTO-LITHOGRAPHY.

M. Paul proposes the substitution of albumen for gelatin in the bichromate process. The paper is covered with a thin layer of albumen, to which a concentrated solution of bichromate is added. After sufficient exposure under the negative, the sheet is covered with lithographic ink and then immersed in cold water in order to dissolve the unaltered albumen, which is removed by fine sponge. A very clear image, it is said, is thus obtained, ready to transfer to the stone.

PHYSIOLOGICAL PROPERTIES OF CAFFEIN.

The physiological action of coffee, according to MM. Aubert and Haase, should not be attributed to caffein, but to other principles. An injection of 0·6 cubic inch of coffee containing 0·6 grain of caffein killed a rabbit in a very short time, producing acceleration of the pulse and respiratory organs, uneasiness, and finally convulsions. An injection of 0·75 grain of pure caffein, however, did not produce death nor even any symptoms of sickness. An infusion of 770 grains of very hot coffee, corresponding to 6·3 grains of caffein, acts upon a man far more intensely than a stronger dose of pure caffein. Headache, vertigo, trembling, and similar symptoms are produced, which last upward of four hours. Coffee extract, deprived of caffein by chloroform and injected into the jugular vein of a rabbit, causes strong convulsions, but never tetanus, such as is produced by an overdose of caffein singly.

JAMES VICK, the Rochester (N. Y.) seedsman and florist, informs us that he manufactures and sells the tent roof garden chair illustrated in this journal some time ago. It will be remembered that we recommended its introduction in this country. We are glad that our suggestion has been anticipated.

MR. A. PELL desires such of our readers as have old numbers of the SCIENTIFIC AMERICAN which they do not want, to send them to No. 18 East 30th street, New York city. Any papers sent will be distributed in the Bellevue Hospital and other charitable institutions, where they are frequently asked for and eagerly read by the patients.

A STRONG colony of bees has been known to build one hundred square inches of comb in twenty-four hours; at that rate, over sixty sheets of comb a foot square could be constructed in three months. The *Annals of Bee Culture*, mentions a swarm that built nine sheets of comb, ten by thirteen inches, in ten days.

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THE CRYSTAL SELF-ACTING TABLE FOUNTAIN.

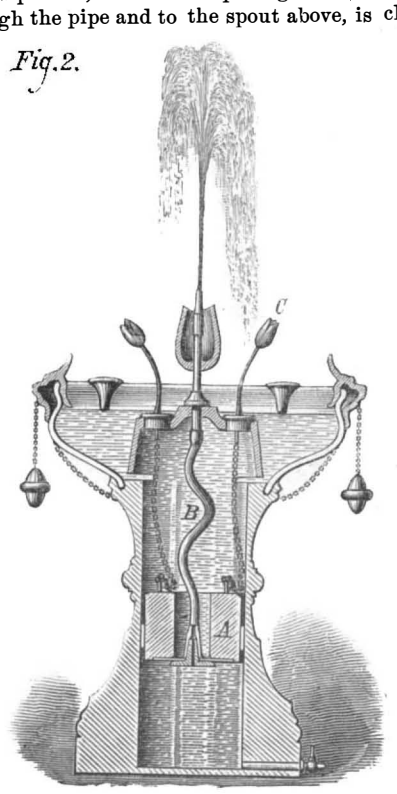
Nature's ornaments are the standard of beauty; and the more closely art copies her ever varying forms, the higher and purer does it become. A spray of ivy creeping over a cornice, a handful of flowers, not imbedded in a stiff mass but allowed to rest loosely in a simple vase, a jet of crystal water dancing and playing like a shower of diamonds in some sunny corner, are far more exquisite than the most elaborate decorations or gorgeous fittings that the most skillful of workmen can produce.

Fig. 1

But nature may be assisted by art, so that her handiwork may exist in places where it would otherwise be absent; and tne ingenuity of the inventor is not at a loss to find a way of bringing into our parlors the beauties which we admire in the garden. Such indeed is the object of the ornamental little device to which our engravings refer, and by which we are enabled to place a miniature fountain, with its floral accompaniments, in the center of our dining tables, if we so desire it. Apart from its beauty as an ornament, it may here be noted that a jet of water in the room tends toward moistening the atmosphere, and relieving it of the dry nature especially due to furnace heat, while, besides this, the fluid has a tendency to absorb the foul gases due to respiration. Hence the invention is desirable both from an æsthetic and a sanitary point of view, while it has, as we are informed, the further merit of being within a moderate limit of cost.

In our illustrations, Fig. 1 shows the apparatus entire and Fig. 2 is a vertical section. There is a pedestal, which may be of imitation bronze or any other desired material and made in any handsome design. In this is a cylindrical space in which fits a heavy plunger, A. Through the latter is an opening into which passes a rubber pipe, B, of smallerdiameter, and which terminates below in a flap valve. The valve, however, is pierced, so that the opening from the water below, through the pipe and to the spout above, is clear.

Fig. 2.



To start the fountain, in which clear, colored, or perfumed water, or even *eau de cologne*, may be used, the plunger is drawn up to the highest position by means of the chains which connect with the movable metal tulip buds, C. While this is being thus elevated, the water above passes through the annular space between the pipe and the periphery of the orifice in the plunger, and escapes below, the valve, of course, opening downward. The plunger, however, on being left to itself, descends by its own gravity, pressing upon the water below, which, unable to ascend through the annular space on account of the closing of the valve, is forced through the small central opening in the latter, through the pipe, B, and, finally, out at the spout in a fine jet sixteen or eighteen inches high. The basin communicating with the cylinder, of course, never overflows, and the play of the fountain continues until the plunger has reached the bottom, which, with a small jet, occupies a period of about forty-five minutes. The lifting of the plunger is very easily done, and is hardly two seconds' work. The glass tulip shown near the jet is designed to hold flowers, and the same are also arranged in holders attached to the side of the basin. By being continuously sprinkled with water, they are thus kept fresh for quite a long time. At the bottom is a conduit and cock for drawing off the water, and a suitable strainer is provided at the jet to prevent the same from clogging.

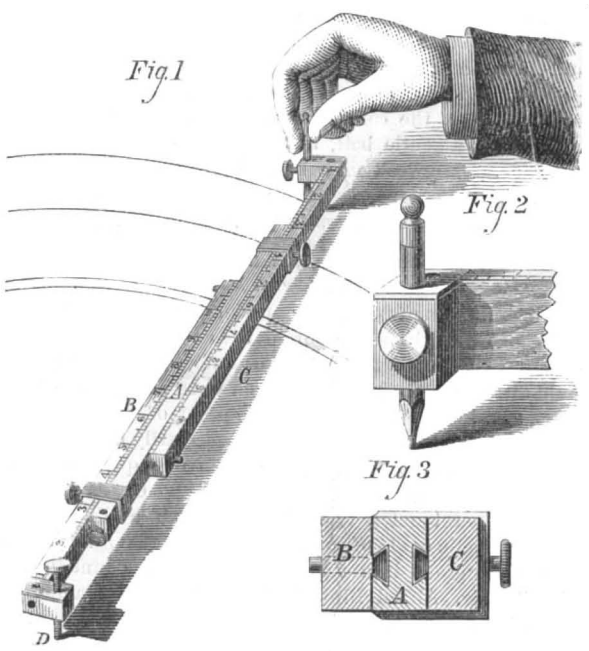
The decorations are quite tasteful, and the ornament, as a whole, will be a handsome addition to any parlor.

Patents for the fountain are now pending. For further particulars, address the American Fountain Works, New Haven, Conn.

COMBINED EXTENSION MEASURING ROD AND DIVIDER.

The object of the invention herewith illustrated is to facilitate the taking of measurements between rigid surfaces, and the striking of circles, arcs, ovals, or ellipses. It appears to be quite a handy little instrument, and will doubtless prove a convenient device for builders and mechanics.

There is a center piece, A, Fig. 1, in each of the two opposite sides of which is made a dovetail groove for the reception of metallic dovetails attached to the inner sides of the extension pieces, B and C. This arrangement is clearly shown in section in Fig. 3. Secured also to the center piece are suitable bands for holding the extension arms, which are provided with thumbscrews, so that the latter may be fastened in any desired position. The pieces, B and C, are graduated in inches and fractions, so that the length of the rod may be at any time easily ascertained. At D is a removable point secured by a thumbscrew, and at the opposite



extremity of the apparatus, shown in Fig. 2, is a simple arrangement for holding an ordinary pencil. The mode of using the device for striking circles is obvious from our engraving. In making ellipses, the third point is attached to the end of the center piece. When not used as a tram, the points and pencil may be disposed of in suitable holes made in the ends of the pieces.

Patented through the Scientific American Patent Agency, November 4, 1873. For further particulars address the inventor, Mr. George H. Discher, Mobile, Ala.

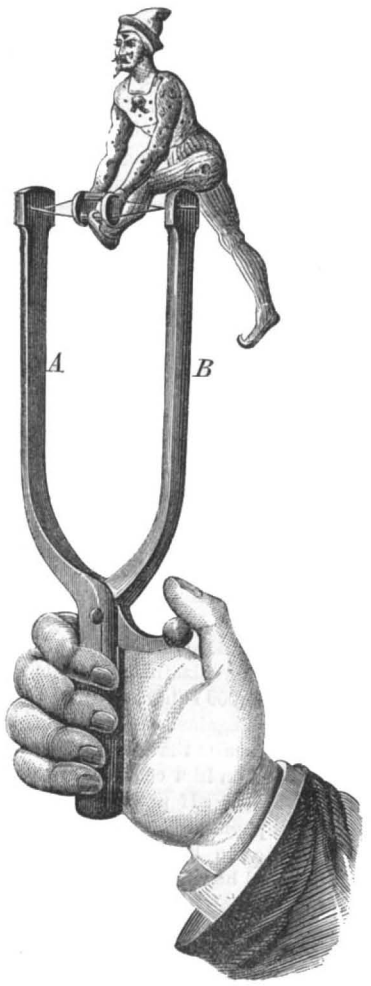
The Sea Mouse.

The sea mouse is one of the prettiest creatures that lives under the waters. It sparkles like a diamond and is radiant with all the colors of the rainbow, although it lives in the mud at the bottom of the ocean. It should not have been called a mouse, for it is larger than a big rat. It is covered with scales that move up and down as it breathes, and glitters like gold shining through a flocky down, from which fine silky bristles wave that constantly change from one brilliant tint into another, so that, as Cuvier, the great naturalist, says, the plumage of the humming bird is not more beautiful. Sea mice are sometimes thrown up on the beach by storms.—*Hearth and Home.*

TOY GYMNAST.

This is one of those ingenious mechanical toys which are sure to amuse and please children of all ages, though it it is nothing but an articulated figure which, supported between two upright bars, goes through a variety of ludicrous antics. The performer is made of pasteboard, and has his legs and arms pivoted to his body. The hands are kept apart by two short tubes through which pass a couple of strings which are secured to the tops of two bars, A and B. Bar A is curved and projects downward into the handle. The other, B, is also curved, and its lower end terminates in a thumb piece, which enters and is pivoted in a groove in the upper part of the handle of bar A.

All that is necessary to do in order to make the figure execute a number of astonishingly impossible gymnastic feats is to press down the thumb piece, as shown in our engraving. By this means, the upper ends of the bars are forced apart, and the motion of the gymnast regulated according to the quantity of pressure applied. The inventor also adds hooked



toes to the feet, so that the latter will catch in the tubes between the hands, and thus give the performances of the figure a more grotesque appearance. This is just the article to find ready sale during the holidays.

It was patented November 18, 1873, through the Scientific American Patent Agency, by Mr. Frederick A. Bancker, of whom further particulars may be obtained by addressing P. O. box 180, Brooklyn, N. Y.

MOISTENING DEVICE FOR LAME ANIMALS.

Mr. George J. Harris, of New York city, has recently patented an apparatus by means of which the legs or feet of a horse, or other animal, may be kept moist for any desired time. He arranges an india rubber water bag around the neck and leads therefrom flexible pipes, which extend to the legs of the animal. These pipes, at A, are connected to tubular sprinklers, which are so constructed that they can be conveniently secured either below the knee or below the ankle joint. They are also perforated with a number of

minute holes, and are enveloped in flannel or other suitable absorbent material, so that water or liniment, which oozes slowly out, is distributed over the entire surface of the legs or feet.

By this means a sufficient quantity of liquid is supplied to keep the extremities of the animal damp for a considerable period of time; and when the device is once adjusted, it needs no further attention until the receptacle is empty.

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CHINESE FRESH WATER FISH.

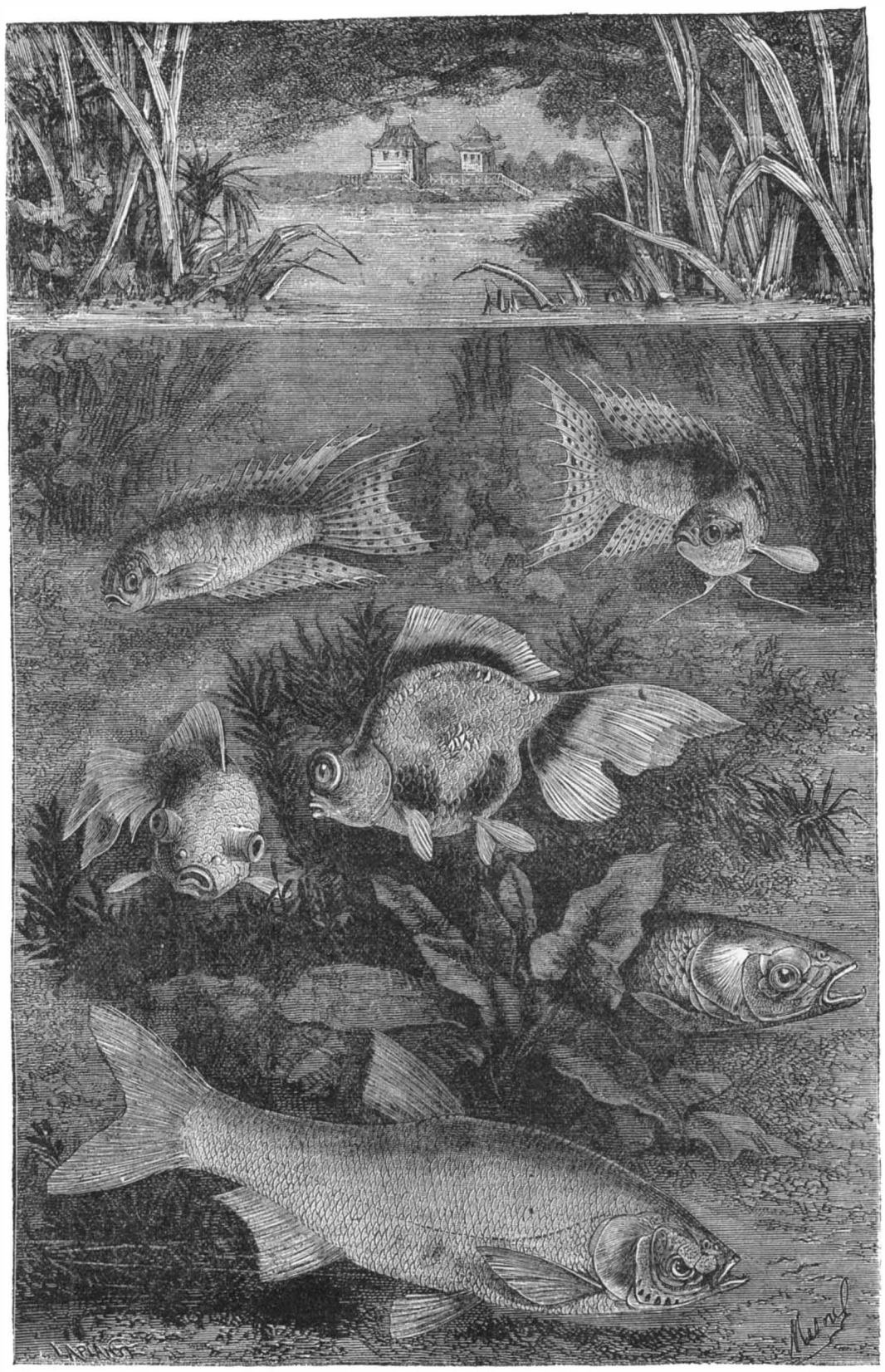
There is a common belief that the queer animals represented in the grotesque designs of Chinese artists are in the main chimerical, and have no existence save in the imaginations of their delineators. It is a fact, however, that the reverse is, in some instances, the case, and that many of these beings really live, though perhaps in a form hardly so exaggerated as depicted in the works of celestial art. A French pisciculturist, M. Carbonnier, has recently succeeded in transporting several strange varieties of fish to France, and, as we learn from *La Nature*, has found it possible to acclimatize them, and hence to study their habits of life, reproduction, etc. Four species of these odd animals are represented in the accompanying engraving. The pair nearest the surface of the water are *macropodes*, small fish, pale gray in color, and, at first sight, having little about them to attract attention. As soon as the animal becomes excited, however, the long fins on the back and belly straighten out and assume a rich purple hue tinted with green; the long and fork-shaped tail spreads into a kind of fan, and the stripes upon the sides of the fish become yellow, red, and blue, constantly changing in color. The scales seem to become opalescent, and reflect the light with the greatest brilliancy, while the eyes appear illuminated with a bluish green fire. These beautiful peculiarities of the fish have gained for it the popular name of Fish of Paradise.

The habits of the animal are as odd as its appearance. The males take charge of the young and build the nest. The latter is simply a clot of foam floating upon the water, and is made by the fish rising to the surface and alternately absorbing and expelling air, until a little cluster of fine bubbles, hardly three tenths of an inch square, is formed. The female then deposits her eggs, which are at once seized upon by the male, who carries them in his mouth to the nest. Then he watches their incubation, carefully guarding and distributing them with wonderful sagacity evenly throughout the mass of foam. When they clot together, he pushes them apart with his nose, and, besides, keeps up a continual manufacture of bubbles until the eggs are lifted up above the water and rest only upon their soft couch. As soon as the embryos appear, his care is doubled. He watches that none escape; and in case some become separated, he chases them, catches them in his mouth, and replaces them carefully in the nest. If one becomes injured, he removes it from the others, and gives it a separate air bubble to itself, and apparently nurses it until it regains strength.

The *macropodes* belong to a family known as *labyrinthiform pharyngiens*, and their peculiar construction enables them to keep their gills moist for a very long time. They can pass through half dry marshes by maintaining their equilibrium with their fins and propelling themselves by the sharp toothed points with which the latter terminate.

The two grotesque-looking fish represented in our engraving, just below the *macropodes*, are of the genus *cyprinus*, and are termed telescope fish. The body is apparently gilded on its lower portion and of a deep velvet black above, while its form is globular. The dorsal fins are double, and the tail extends into a long curved fan. The eyes project sometimes as far as an inch and a half beyond the head, and resemble the lens and tube of a telescope. The habits of this strange animal are as odd as its shape, and it is said that its equilibrium in the water is very unstable, so that it even swims with difficulty.

The two species shown near the bottom belong to the same genus *cyprinus*, and are known to science as the *leuciscus idellus* and the *hypophthalmichthys molitrix*. There seems to be nothing extraordinary about the habits or form, and the value of the fish lies in its quality as food. Its flesh is said to be excellent, and the animal, when adult, often attains a weight of fifty pounds. The Chinese raise these fish in great numbers in artificial ponds.



CHINESE FRESH WATER FISH.

How the Heathen Chinee catches Fish.

M. de Thiersant, lately a French consul in China, has published in France a quite interesting work on pisciculture and the mode of fishing in that country. He states, among other facts, that over 850 different kinds of fish exist in Chinese waters, many of which are of species hitherto unknown to European naturalists. Several varieties have for centuries been selected as fit for food and cultivation, and hence pisciculture or the ordinary domestic raising of fish, an industry here in its infancy, is far from a novel idea in the Celestial Empire. The author presents a vast number of interesting details on his general topic, from among which we select the following curious ideas:

The cormorant is largely employed as an assistant to the fisherman, and is carefully educated to its work by professional trainers. When thoroughly trained, a pair of birds is worth 40 dollars, the high price being explained by the cost and labor of instruction. During the first seven months of its life, the cormorant is left with the flock and is taught by its elders how to feed itself on small fish. After that age however, a collar is fastened about its neck so that it cannot swallow its prey, and to one of its feet a cord some two feet long is attached, terminating in a bamboo float. At a signal from the fisherman, whose sole implement is a forked stick some ten feet long, the cormorants plunge into the water and search for fish, each bird, as fast as he catches one in his beak, rising to the surface. The fisherman then hooks the bird's float with his stick and draws it towards him, taking the fish away from the cormorant as soon as it comes within reach of his arm. When the fish is very large and weighs seven or eight pounds, for example, the cormorants will assist each other, one catching the fish by the tail, another by the head, etc. They rarely catch anything weighing less than a quarter of a pound. After every capture a small bit of fish is thrown to the bird as a reward, the piece being sufficiently little for it to swallow in spite of its collar. Chinese fishermen keep their feathered assistants at work as long as daylight lasts. Occasionally the birds become tired and refuse to dive, a proceeding which occasions a series of frightful yells and beating of the water with a stick by their master, which frightens them to such an extent that they resume labor instantly. This mode of fishing, which is not interrupted even by severe cold, is quite lucrative, as twenty or thirty birds can readily catch about a dollar and a half worth of fish per day. In general the fishermen are associated, and the birds belong to a society which marks them with a peculiar brand of its own. Oil of sesame is said to be the panacea for all ills of the cormorant, which continues its career of active work until about ten years of age.

The Chinese have also queer ways of catching water fowl. Sometimes they spread great vertical nets with large meshes near the surface of the water, so that the wings of the birds become entangled therein just before they alight. Another arrangement is a sort of net trap held open by the bamboo sticks which, when the birds perch upon them, fall and allow the game to become entangled in the meshes. Perhaps the most ingenious idea is carried out by men who enter the water entirely nude, wading in up to their necks. Over the head is placed a sort of helmet, which is pierced with holes for sight, breathing, etc.; and resting on the man's shoulders is a wooden shelf on which, just in front of the sight orifices of the helmet, is placed a number of cups containing corn or seed. The bird, attracted by the bait, alights upon the shelf, when the fowler grabs his prey by the legs with his hand, draws it under the surface, and secures it in a net bag which is worn about his waist.

Hairy Men.

Two remarkable instances of hairy men arrived recently in Berlin. They are Russians, father and son, and have excited so much interest that Professor Virchow has delivered a lecture upon the phenomenon, an abstract of which appears in the *Edinburgh Medical Journal*.

They are peculiarly remarkable in being edentulous. They are not hairy men in the ordinary acceptation of the term, but more resemble some of the monkey tribe (the Diana monkey, cuxio, etc.); while their edentulous condition carries them yet lower in the animal scale. The eldest is a man aged over 55, Andrian by name, said to be the son of a Russian soldier from the district of Kostroma. He was born during the period of service of his reputed father, and has no resemblance to him, to his mother, or to a brother and sister whom he possesses. To escape the unkindness of his fellow villagers, Andrian fled to the woods, where he lived in a cave, and was much given to drunkenness; even yet he is said to live chiefly on sauerkraut and schnapps; but his mental condition, which is truly none of the sharpest, does not seem to have suffered, and he is, on the whole, of a kindly disposition, and affectionate to his son, and to those about him. Andrian was married, and had two children, who died young; one of these was a girl resembling her father; but of the other, a boy, nothing can be ascertained. Fedor, the boy, exhibited with him, is three years old, and comes from the same village; he is said to be Andrian's son, born in concubinage; and it is most probable that this is the case, as it would be singular were two such creatures to originate independently in one small village. The peculiarity of these individuals is that they have an excessive growth of hair upon one particular part of the body, namely, the face and neck; on the body and lower extremities there is also a stronger growth of hair; and particularly on the back and arms of the child, there are sundry patches of 0·15 inch to 0·24 inch in diameter, covered with soft yellowish white hair 0·12 to 0·24 inch long. Andrian himself has on his body isolated patches strewn, but not thickly, with hair 1·5 inches to 2 inches long. But all this is trifling and subordinate compared with the hair growth on the face, to which attention is mainly directed. Andrian has only the left eye tooth in the upper jaw; Virchow has not stated how many teeth are in his lower jaw, but from the

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context it is improbable that he has more than his son, namely, four incisors. The son has no teeth, hardly any alveolar process, and the upper lip is very narrow, so that the upper jaw appears depressed; the father presents the same appearance. It is somewhat singular that a similar family has long been known to exist at Ava, and was first described by Crawford in 1829, and since then by Beigel. Three generations of this family are now known to exist. The grandfather, Shwe-Maon, had a daughter Maphoon, and she again a son, all of whom present precisely the same peculiarities as in the family of Andrian, not only as to the growth of hair, but also as to the teeth. The grandfather has in the upper jaw only four incisors, in the lower jaw four incisors and one eye tooth; and these teeth did not appear till he was twenty years of age. Maphoon has only four incisors in each jaw; the eye teeth and molars are wholly wanting; the first two incisors appeared during her second year. The peculiarity of the hairiness in these individuals is of the same type as in Adrian and his son, in whom every part of the face and neck, usually only covered with lanugo, is covered with long hair, the very eyelids being so covered, the eyelashes being normal, while flowing locks come out of both nostrils, and also out of the *meatus auditorius externus*. At first sight, the occurrence of two such families in two such distinct parts of the world, seems to point them out as "missing links"—as the unreformed descendants of an earlier race of man. And our thoughts are carried back to the Ainos or hairy Kuriles, who are believed to be the remains of the aborigines of Japan, and who now inhabit the northern parts of the Island of Yesso and the southern part of the island of Saghalien. At first these aborigines were stated to be as hairy as our wild men; but from more accurate information, obtained by the Berlin Anthropological Society through the German resident Herr Von Brandt, accompanied by numerous photographs and Japanese pictures of these Ainos, and from an examination of a skull recently obtained through Privy Councillor Von Pelican, Virchow is able to state with positiveness that, neither in respect of the formation of hair nor in regard to the teeth, have the Ainos any analogy with the Russian or Burmese hairy men. The Ainos are certainly hairier on the chest and extremities than the nations around them, but there is nothing peculiar in the distribution of the hair, and the males have hair only on the typical parts peculiar to man. There is not a shadow of a race connection between the Ainos and the Russian hairy men, and only the most prurient imagination could connect the latter with the Burmese family. No doubt, careful breeding could raise a new race of men from this accidental variety, just as various new races of domestic animals, dogs, for instance, have been propagated from accidental varieties. Virchow, however, believes that the peculiarities, belonging to the Russian as well as to the Burmese families, depend upon idiosyncrasies of innervation, and these upon accidental congenital abnormalities in the *trigeminus*, within whose domain all these features present themselves, only to be ascertained by careful dissection.

Recent American and Foreign Patents.

Improved Scrubbing Brush.

Carl Herold, formerly of Pittsburgh but now residing with Mr. Vock, 52 Ludlow street, New York city.—This invention is designed to furnish a scrubbing brush which contains a reservoir to hold water, soapsuds, or other cleansing liquid. This reservoir is in the brush back, in which a small air hole is made, the closing of which by the finger, while the brush is in use, will stop the flow of the liquid; or the hole may be provided with a valve. The improvement may be applied to blacking brushes, for which it is especially suitable. Further information may be had by addressing Mr. Herold as above.

Improved Grain Separator.

Joseph Koons, New Auburn, Minn.—This invention is an improved grain separator, so constructed as to thoroughly separate the grain from the straw as they come from the thrasher, clean the grain and remove it, and carry the straw out of the machine and deposit it upon the stack. The frame of the machine is rectangular in form, and is incased upon its top and sides. The frame is from twelve to fourteen feet long, about four and a half feet high, and from three to four and a half feet wide. Two shafts revolve in a side bar, and to each are attached two wheels, which work in circular spaces in the casing of the machine, so that the straw and grain cannot escape. The wheels are connected near the rims, at their upper and lower parts, by two rods, the points of attachment of which form an angle with each other of one hundred and sixty degrees. The upper rods connect with the separating rack, the slats of which are provided with teeth, inclining forward, so that as the rack moves upward and forward it may carry the straw with it and may slide beneath the straw as it moves downward and rearward. By this construction, as the shafts are rocked, the rack receives the vertical and horizontal movements necessary to properly separate the grain from the straw and carry the straw forward. To the lower rods is attached the conductor which receives the grain from the rack and conducts it to the sieves. To the forward end of the conductor are attached fingers to break up the sheet of grain as it falls to the shoe or sieves. The conductor has the same vertical and horizontal movement as the rack. By suitable mechanism, the horizontal and vertical movements of the rack and conductor may be regulated at will. This adjustment enables the forward movement of the straw to be accelerated or retarded, as required.

Improved Corn Planter.

Charles Hutchins, Aubrey, Kan., assignor to himself and Abram Large, of same place.—The seed-dropping mechanism consists of a slide which moves in guide slots of the hopper, at the bottom of the same. The slide is arranged with a band spring, to which is connected a lug which is acted upon by knobs attached to the spokes of the wheels, according to the distance at which the corn is to be planted. The knobs carry the spring and slide forward, and drop the seed inside of plow to the ground. As soon as the spring is released, the slide closes the hopper till actuated again by a knob. Cross pieces are attached to the circumference of wheels diametrically opposite to the knobs, for the purpose of marking the exact place at which the corn has been dropped. The driver is thereby enabled to see at any time whether he is planting in rows or not. As soon as he finds himself not exactly in line, he can, by placing his foot on the lever, raise the front wheels on the pivots, and regulate the planting by simply turning the wheels forward or backward, which allows him to plant as straight one way as the other. The broad concave hind wheels are placed back of the plows, and serve to cover the corn dropped in the furrows. By means of a lever which is operated by the foot of the driver, the pivoted frame with the wheels is raised, and thereby the planting interrupted at will, as required in turning the planter or moving from place to place.

Improved Reciprocating Engine.

Samuel J. Jones, Helena, Montana Ter.—The piston rod extends through both cylinder heads, and disks fit thereon, one each side of the piston, and work airtight in the cylinder. On the upper side of the latter are induction ports for the air, and valves for opening and closing them, which are connected by a valve rod. Short rods project into either end of the cylinder, by which the levers are thrown to work the valves, by means of the disks, which strike the rods when forced against the cylinder heads. The steam ports are on the lower side as is also an injection port for water, to condense the steam after having thrown the shuttle to expel the air through the clack valves and shift the air valves. Supposing the engine to be standing with its piston at its forward end, and the valve shifted to admit steam at the front port, the rear disk will thereby be driven to the other end of the cylinder, expelling the air; and just before arriving at the piston head, it will strike the short rod at that end, and close the right hand air port, and open the left hand port; at the same time, if the injecting port be opened and water admitted, the steam will be condensed and a vacuum formed, so that the air admitted will drive the piston and other disk over to the right, with all the force due to the difference of the pressures on the two sides of the piston, which, in practice, will probably be about twelve or thirteen pounds to the square inch. At the same time the injection port should be closed to shut off the water; then if steam be admitted between the rear disk and the piston, it will be driven back to the left, expelling the air and water at that end, and taking their place to form a vacuum again by being condensed by water admitted; so that, as soon as the rear disk arrives at the end of its movement and strikes the rod, the air would be admitted behind the piston, and drive it back to the place of beginning, and so on.

Improved Safety Valve.

James Hoffman, Belvidere, N. J.—A short vertical pipe rises up from the top of the steam chamber, having a considerable enlargement near the upper end, which is bored out cylindrically, and, at a suitable distance above the bottom, perforated with numerous holes. The safety valve proper is seated at the top of the small bore of the pipe, and is provided with a cylindrical attachment fitted to the bore, as nearly steam tight as it can be and work up and down a short distance without friction. After the steam has lifted the valve, it cannot escape until the attachment rises as high as the lateral holes. By this means, the lifting of the valve high enough to insure the opening of the escape to the full capacity of the bore will be caused.

Improved Wood Molding.

Leonard Bushnell, New Bedford, Mass.—This invention consists in a wooden or other molding, provided with stamped ornamental figures or signs in intaglio, having the sides of the recesses beveled and inwardly inclined, to facilitate the operation of gilding.

Improved Wheel for Vehicles.

Joseph H. Glover, Freedom, Ky.—An octagonal tube has a screw thread cut upon each end, and is lined at each end with antifriction metal, to form the bearings for the axle. The two hubs have octagonal holes formed through their centers, to fit and slide upon the tube; and in their outer sides are formed dovetailed recesses to receive the dovetailed inner ends of the spokes, which are kept in place by plates bolted to the hubs. The inner part of the plates is rabbeted to receive the flange formed upon nuts, which hold the hubs and plates in place, and also move said hubs and plates out and in. The corresponding spokes from the two hubs meet at their middle parts, and their outer parts are connected together. The outer ends of the spokes have tenons, which enter holes in a rim, which is made convex upon its inner side and concave upon its outer side, which construction prevents the wheel from slipping. By this construction the spokes are shortened by spreading their inner forked ends apart by turning the nuts outward. This shortens the spokes and loosens the rim. By turning the nuts inward, the inner ends of the forked spokes will be moved toward each other, the spokes will be lengthened, and the rim tightened.

Improved Car Coupling.

Xavier St. Pierre, Ophir City, Utah Terr.—This invention consists of a pair of spring jaws, side by side, with heads or enlargements near the front end between which a double headed coupler enters. The latter is secured by the heads of the jaws engaging it behind its enlargement, the jaws being confined against springing open by a forked locking key, which drops down with one of its prongs on each side. The forked locking device is raised and lowered by a handled elbow lever; and a catch is combined with said lever, to engage it just after it has raised the locking device, and hold it up until the cars are to be coupled again. This catch is so coupled with one of the spring coupling jaws that, when it is swung back by the lever to allow it to pass beyond said catch, the latter is caused to withdraw the said coupling jaw, to allow the coupler to escape freely and uncouple the cars. A spring is combined with the elbow lever of the locking device, to insure the return of the latter to confine the coupling jaws when the elbow lever is released by the spring catch.

Improved Overalls.

Emil Weil, New York city, assignor to Stern & Co., of same place.—The object of this invention is to furnish overalls readily applied without the use of buttons, suspenders, etc., fitting the body of the person, and self-adjusting to the position of the same. It consists of short elastic bands, inserted and applied into the band piece of the overalls, and closed by a common belt buckle, which is drawn through a slit of a flap attached to the lower front edge of the overalls, and covered by the same.

Improved Apparatus for Puddling Iron.

Joseph Davies, Knoxville, Tenn.—On the rod or shaft of the puddling tool is a pulley for revolving it. The pulley is fitted by a journal at one end in a bearing in a standard, and the shaft is fitted in the pulley so as to slide freely endwise, and has a long key or spline working in a groove in the pulley, to be revolved at the same time. The standard is jointed to a section which is seated by a collar on the bench, and has a cylindrical extension passing down through a long slot in the bench top, which is secured by a pin. The bench ranges parallel with the front of the furnace, and is pivoted just above the ground so as to swing toward and from the furnace. The handle portion of the puddling tool rod does not revolve with it when held by the attendant for directing the tool. It will be seen that the tool can be moved in and out by sliding in the pulley in which it is supported; also, by swinging the bench forward and backward on the pivots, that it can be swung horizontally on the bench by turning the section of the support, and that it can be shifted along the bench parallel with the furnace, and thus all necessary movements can be made to work the tool in all parts of the furnace to manipulate the iron for puddling and balling.

Improved Portable Stove.

Rice Moore, Nashville, Tenn.—This invention relates particularly to the arrangement of a damper and apertured horizontal diaphragm in an upper chamber of the stove, whereby the course of the heat and products of combustion is controlled with reference to their effect on a culinary vessel set into said chamber. A small vertical rectangular case is mounted on short legs and contains a fire pot, flue, oven, and chamber. The fire pot extends downward a little below the bottom of the other portion of the stove, and has a perforated bottom and sides. The combustion chamber extends up through the oven space at one side, and discharges into the heating chamber, and a door opens into it for supplying the fuel. On the side of the stove opposite to the fuel door is the oven door. The boiling and stewing vessels are made long enough to extend through the heating chamber into the oven, through the top, to utilize the heat of the oven for boiling, stewing, etc. A plate is arranged in the chamber, parallel to the top of the oven, dividing it horizontally into two parts. Immediately over the combustion chamber said plate has an opening which can be partially closed by a sliding damper. By adjusting the damper, a large share of the products of combustion will be diverted to pass beneath and around the end of the plate before reaching the flue, while the remaining portion will pass vertically into the same through the openings on each side of the damper.

Improved Tomb.

Joseph C. Taylor, Roanoke, Ala.—This invention has reference to a tomb or grave cover which is composed of a base or pedestal of masonry, upon which is placed a slab of artificial stone resembling marble, formed by molding upon said base a composition of hydraulic cement, sand, and water, or their equivalents.

Improved Horse Power.

John S. Tadlock, Belmont, Texas, assignor to himself and J. M. Howell, same place.—This invention relates to railway horse powers; and it consists of cog wheels on the drums over which the endless chain travels, gearing with large multiplying wheels, one on each side of the chain. Between these wheels is a drum on the same shaft, on which the chain rests, so as to be carried in returning to the upper side; and the multiplying wheels are geared with a counter shaft having pinions and transmitting pulleys, from which the motion is taken by belts. The frame supporting the endless chain rests by the wheels of its drums on the large multiplying wheels, and can be shifted so as to ascend from either side to run the machine in either direction, and to change the inclination for varying the speed. The drums of the endless chain are weighted to prevent them from jumping out of gear with the multiplying wheels.

Improved Apparatus for Filling Cans with Tomatoes, etc.

Charles S. Bucklin, Red Bank, N. J.—There is an inclined tube, tapering or funnel-shaped, at its lower end, which terminates in a small pipe. An adjustable can holder is placed in front of the end of the tube and provided with a movable cut-off plate. In the tube is a piston, connected with a counterpoise. The tomatoes being placed in the receptacle through a suitably arranged hopper, the piston, being caused to descend by pressing a treadle, forces the contents out of the tube and into the can. When the latter is full, the cut-off plate is placed so that its opening no longer corresponds with the end of the tube, so that its solid portion prevents the escape of the tomatoes after the can is removed. A trough is placed in such a position as to receive any of the substance being canned that may escape from the tube, or may be spilled while filling the cans, and conduct it to a receptacle placed at the rear of the machine.

Attaching Stereotype Plates to Blocks.

Marshall J. Hughes, New York city.—A stereotype plate is cast on and around a wooden block or blocks, and thus attached thereto so that, when an impression is taken, it can be "locked up" without the delay and preliminary labor required to attach the ordinary stereotype plates to blocks or backing. The invention is important to printers, especially to proprietors of country journals and others who use selected matter, also to advertisers in general.

Improved Cotton Chopper and Cultivator.

Mansfield L. Nearn, Double Bridges, Tenn.—This invention is an improvement in the mode of attaching shovels to the standards of cultivators, more especially those employed in cotton culture. The invention consists in forming two parallel vertical slots in the shovels, through which bands or straps of sheet metal are passed, and in forming notches or recesses in the sides of the standards in which said bands or straps are laid and secured.

Improved Car Coupling.

William R. Coovert, London, Pa.—This invention is an improvement in the class of car couplings formed mainly of arrow-headed links or draft bars, and pivoted latch blocks engaging therewith. The invention consists in connecting a draft bar to a pivoted block having a ratchet mechanism for elevating it, so that the pin which connects the two will be disengaged from the draft bar when the pivoted block is raised.

Improved Farm Gate.

Jacob C. Rohrer, Gomer, Ohio.—The frame consists of two vertical side pieces, of which the stronger piece is placed sidewise of the main post of the gate, turning with its lower end in a recessed block which is set securely into the ground. The upper part of the piece is recessed and turns in arms, which are applied to the top of the main post. The two vertical pieces are laterally connected by a top piece, diagonal brace, and horizontal piece. The vertical pieces, and also the diagonal brace, are recessed sufficiently for the passage of the horizontal pieces. The upper piece of the gate is carried by rollers, so that the gate slides easily in the frame forward and backward. The vertical end pieces limit the extent of sliding the frame, being, however, so constructed that that part of the gate which extends beyond the stronger piece balances the fore part of the gate and frame, so that the whole gate swings readily and easily in bearings.

Improved Composition for Removing Incrustation in Boilers.

Charles Burfitt, New Wimbledon, England.—The composition is made in three different forms—that is to say, in block, in liquid, and in paste. The block composition is compounded of oak galls, Australian bark, soda, glue, Irish moss, and filtered water; to be set by the application of 170° of heat. Into the vessel in which the above ingredients are mixed is put a small quantity of arsenic. The liquid composition is oak galls, Australian bark, soda, Irish moss, and filtered water, boiled together for three hours. The paste composition is oak galls, Irish moss, Australian bark, soda, and filtered water, boiled to 120°. Tannic acid from vegetable matter is finally added.

Improved Shaving Mug.

Andrew J. Furr and Walter C. Knaus, Boonsborough, Mo.—This invention is an improved shaving cup, so constructed that the water may be warmed and kept warm by a small lamp connected with the cup itself. A suitable chimney, as well as receptacles for brush and soap, is provided.

Improved Glove.

Thomas G. Foster, Gloversville, N. Y.—This invention relates to gloves made of buckskin or other material; and it consists in the palm side and finger pieces cut in a single piece, with the finger and thumb pieces sufficiently long to turn over the ends of the finger and thumb, and be attached to the material on the back.

Improved Overflow Alarm.

Thomas Mayes, Albany, N. Y.—The alarm mechanism may be of any suitable kind. There is a lever for holding it when it is not required to be sounded, and a catch for tripping said lever. A float is arranged in the drip pan to disengage said lever when the fluid rises in the pan nearly to the point of overflowing. It is proposed to use a tilting pan to raise the lever by receiving the drip from another pan upon it, the said tilting pan being weighted so that the drip falling on it at the other side of the fulcrum will raise the trip latch.

Improved Composition for Purifying Illuminating Gas.

Samuel P. Parham, New York city.—Sawdust is mixed with lime, to which a solution of copperas in water is added, and the same, together with oxide of iron, thoroughly mixed and stirred, producing thereby a reddish brown composition. This composition is placed into large purifiers, which are alternately brought into use, so that the contents of one may be taken out, and, by exposure to the air, be revived and charged again, till gradually, by long and repeated use, the absorptive power is spent. The sulphureted hydrogen gases are distributed and absorbed in such a manner by the composition that no annoying smell is noticeable at all, and the gas issues from it purer than from the lime purifiers.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From November 15 to November 27, 1873, inclusive.

BOLT MACHINE.—A. Wood, Worcester, Mass.
BRAKE.—G. Westinghouse, Jr., Pittsburgh, Pa.
CONCENTRATOR, ETC.—J. A. Peer *et al.*, San Francisco, Cal.
CONTROLLING DRAFT OF LOCOMOTIVE.—J. Richards *et al.*, Philadelphia, Pa.
ELECTRIC TELEGRAPH.—J. B. Stearns, Boston, Mass.
FURNACE, ETC.—J. F. Harley, Washington, D. C.
GAS ENGINE.—T. B. Fogarty, Warren, Mass.
HARDENING STEEL, ETC.—S. S. Lewis (of New York city), London, Eng
IRONING MACHINE.—G. W. Cottingham, Refugio, Texas.
MAKING IRON, ETC.—H. M. Baker, Williamsburgh, N. Y.
MAKING SCREWS.—C. M. Spencer, Hartford, Conn.
ORGAN ACTION.—T. Winans, Baltimore, Md.
NAIL MACHINE.—National Horse Nail Company, Vergennes, Vt.
PIPE TONGS.—J. R. Brown, Middlesex county, Mass.
PRESERVING FIBERS.—T. Sim, New York city.
PRINTING MACHINE.—G. P. Gordon, Woodbridge, N. J.
RAILWAY AND CARS.—C. W. Hunt, West New Brighton, N. Y.
SHAPING BOOT SOLES.—J. B. Johnson, Lynn, Mass.
WATERPROOF BOOTS, ETC.—F. M. Shepard, New York city.

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Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

ANSWERS TO CORRESPONDENTS

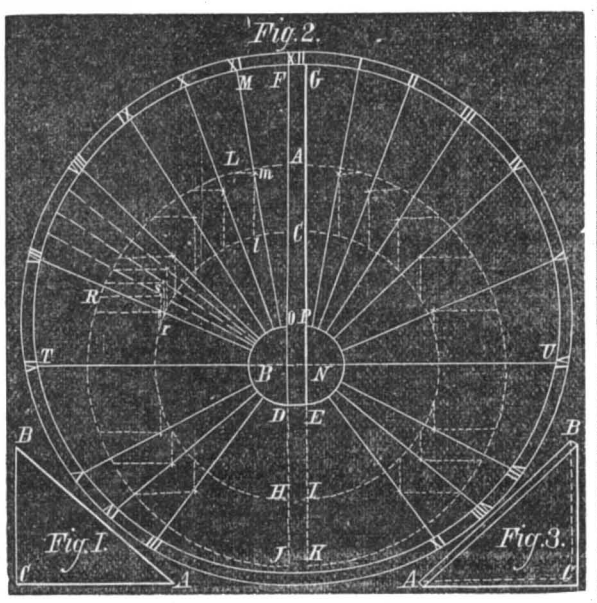
W. H. H. will find a recipe for blackboard composition on p. 299, vol. 28.—M. W. S. will find a description of phosphor bronze on p, 337, vol. 29.—A. G. can soften lead by melting a little tallow with it.—P. A. B. will find the proportions of an astronomical telescope on p. 279, vol. 27.—J. W.'s explanation of the creeping rail difficulty seems to be a correct one.—C. P. H. should refer to our prospectus on p. 410 of this issue, under "Copies of Patents."

S. W. G. asks: 1. In order to turn the face of a circle arm pulley smooth, which side should run towards the tool, the rounding or hollowing side of arm? 2. Which is the proper side to run a circle arm pulley on a shaft, to make it stand the most work? A. 1. The rounding side. 2. In the other direction.

B. C. says: I wish to experiment in making a glass composition, and I do not know in what way to construct a furnace to hold three or five barrels of material. I want a draft that will cause sufficient white heat, and that will allow access to the material in the crucible. If possible, I should wish to draw off the melted composition by means of a sluice gate. 2. What material should I use for the pot or crucible? A. In the manufacture of glass, fire clay crucibles are used, placed in a reverberatory furnace. The glass is generally removed by the workmen in small quantities at a time, adhering to iron rods which are thrust into the crucibles.

J. B. asks: Of what kind of wood should a vat to hold silver solution be made? What should it be covered with inside, asphaltum or paraffin? 2. What kind of a vat is required for nickel solution? I have tried to dissolve nickel with strong oil of vitriol and water. One pint of vitriol with water has only dissolved 1 ounce nickel in 14 days, and that lies at the bottom in powder and not in crystals. A. 1. The trough is generally made of pine, and coated with asphaltum, applied so hot that it will run freely. 2. You will find instructions in regard to nickel plating, on page 266, current volume.

H. C. D. says: Observation has led me to believe that the earth in its yearly motion does not go around the sun. I notice that the earth's termina points of motion are about December 21 and June 21. The books on astronomy teach that "if the earth is in any point of its orbit, the sun will always seem in the opposite point in the heavens. When the earth moves one degree to the west, the sun seems to move the same distance to the east.' Now the sun's apparent termina points of motion are southeast and northeast, and the real terminal points of the earth's motion are southwest and northwest. What is your opinion? A. The earth's orbital motion could not be arrested or its direction changed without vaporizing it by the conversion of motion into heat. Observations similar to your own were doubtless made by the Druids, who erected Stonehenge, a circular assemblage of stones, representing the year. When it was perfect, the sun probably rose from the top of certain altar stones at the solstices and the equinoxes, to a person in a certain position.



L. asks: What is the size of the largest gun yet made in the United States? A. The largest gun made in this country has a bore of 20 inches, and its solid shot weighs about 1060 lbs.

A. B. C. asks: 1. Can a main belt work on the balance wheel of an engine? 2. What kind of belt is best? A. 1. Yes. 2. Any kind of a belt, flat, round, or angular, will answer, if the balance wheel is constructed with reference thereto.

J. N. Q. asks: What is soft iron, used in the construction of an electromagnet? If I want to make an electromagnet out of a bar of soft iron one foot long, does it matter whether it is round, or square, or what shape it is? Does it make any difference how large the bar is, whether the size of No. 16 wire, or an inch in diameter, or any other size? A. We believe Russian iron is the best for this purpose. The bar may be round or square. The size of the bar has a strong influence on the power of the magnet. The magnetism of cylinders of iron of equal length, magnetized by currents of the same force, and having the same number of windings surrounding the core closely, is proportionate to the square roots of the diameters of the cylinder.

E. A. N. asks: How can I soften chilled castings of iron? A. We know of no better plan than to place the castings, surrounded by saw dust, in an iron box, close it up with clay to exclude the air, and subject it to a red heat for several hours. The castings must be cold before they are withdrawn.

C. H. M. asks: 1. Where was the Great Eastern built? 2. What is metaline? A. 1. The Great Eastern was built at the works of John Scott Russell & Co., Millwall, London. 2. We believe the composition of metaline is kept secret by the manufacturers. It is a pressed compound of which plumbago is the base.

E. E. P. says: I run a boiler which carries 55 lbs. steam; I have been using water heated to 125° Fah. What would be the saving in fuel should I use water heated to 210° or 212° Fah.? A. In case all the other conditions were the same, the saving would be as follows: With water heated to 200° = about 7 per cent, to 212° = about 8 per cent.

W. R. says: 1. I have a pistol which I load with powder and ball. I notice that, after firing, the barrel looks as though it had been painted inside with red paint. After a short time, the red color disappears. The powder is the same as I use in a gun without any such appearance. Where does the red come from? 2. How can I remove the bark from a stick to use for a cane without injuring the wood? 3. Would it be likely to crack in seasoning? A. 1. It may be that the red oxide, which is readily decomposed by heat, is formed. 2. The bark can be removed when the stick is green, or afterwards, by steaming or heating it. 3. It should be seasoned slowly to avoid liability to crack.

W. F. H. asks: How can I get the numbers of concave spectacles in the most practical manner? I can get the convex ones correctly by measuring. A. We believe that double concave glasses are numbered in accordance with their radii of curvature. For instance, No. 6 glasses have a radius of curvature of 6 inches.

A. P. asks: Can you tell me how to draw the lines of a horizontal sun dial? A. Draw a triangle A B C, Fig. 1, having the angle, B A C, equal to the latitude of the place in which the dial is to be used. This angle may be laid off by the aid of a protractor, by a table of chords, or by the calculation of the sine and cosine. In our example, we have the angle, B A C, Fig. 1, 40°43′48·5″, which is the latitude of New York city. From a table of sines and cosines, we find that sine of 40°43′48·5″ = 0·652497. Cosine of 40°43′48·5″ = 0·757791. Hence, in Fig. 1, make B C = 0·652497, and A C = 0·757791, on any convenient scale, and join the points A and B by a straight line. B A C will then be the required angle. Next, to construct the hour lines on the dial, draw two parallel lines J F, K G, Fig. 2, at a distance apart equal to the thickness of the style, Fig. 3. Draw a line, T U, perpendicular to these parallels, and mark the points of intersection, B and N. This will be the six o'clock line. From B as a center, draw two semicircles, with radii equal to A B and B C, Fig. 1. Divide each of these semicircles into twelve equal parts. Then from each point of division in the outer semicircle, draw a line parallel to T U, and from each point of the inner semicircle draw a line parallel to J F. The intersections of lines drawn from corresponding points of outer and inner semicircles give points of the hour lines. The hour lines can then be drawn through these points and the center B. To illustrate the construction, from the point L, of the outer semicircle, draw L *m*, parallel to T W. From *l*, the corresponding point of the inner semicircle, draw *l m*, parallel to J F. Then *m*, the point of intersection of the two lines, is a point of the eleven o'clock hour line, and this line may be drawn through B and *m*. To find the quarter hour lines, divide the outer and inner semicircles into four equal parts, between consecutive hour lines. Then draw construction lines, as before from points on the two semicircles, and their intersections will give points of the quarter hour lines, which are to be drawn through the center, B. The construction of these quarter hour lines is shown between the hour lines of VII and VIII. In this way, all the morning hour lines can be constructed. The afternoon hour lines are found in a similar manner, except that they radiate from the center, N, and the semicircles, used in construction, are drawn from the same point as a center. It is not necessary to lay off all the hour lines, but only enough to contain all the hours of the day between earliest sunrise and latest sunset, in the latitude for which the dial is constructed. The style, Fig. 3, should be made so as to have the angle B A C, equal to the latitude of the place. The base of the style should cover the space B N F G. The dial should be carefully levelled and placed so that B N points to the south, and F G to the north. To lay off a north and south line, draw several circles on a board, and place a light rod at the center, perpendicular to the plane of the board. Place the board in a level position, so that a shadow will be cast by the sun from the board. During the morning, mark the points where the shadow just reaches each of the circles, and mark the same points in the afternoon. Then bisect each of the arcs between the points marked in morning and afternoon, and the average direction of a line joining the centers of the circles and the points of bisection will be north and south. This construction, while not strictly accurate, is sufficiently correct, if carefully made. The time given by the dial must be corrected by the equation of time, which may be found in nearly any almanac. It will be observed that the hour lines around noon are closer together than those further removed on either side. For this reason, it is usual to place the center of the dial at a little distance from the center of the hour lines, so as to give greater divergence of the hour lines around noon.

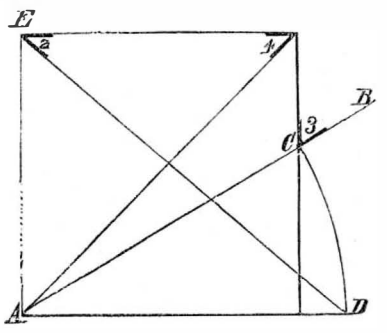
L. P. asks: 1. Is the link a cut-off, or does it wire-draw the steam by shortening the stroke of the valve? It closes the valve sooner or later just equal to what the lead varies, but does it do any more? 2. I am running a propeller 37x30 inches stroke, pressure 40 lbs., vacuum 15 inches, making 50 revolutions, cutting off at about one half stroke. The boilers have 2,500 feet heating surface, the surface condenser, about 600 feet cooling surface. The valve takes steam in the center and exhausts on the outside. It has 1¾ inches lap on the steam side, one thirty-second inch lap on exhaust side. The valve is set where the engine does its work, with seven sixteenths inch lead, mid-stroke lead one half inch, exhaust lead two and five thirty-seconds inches. The eccentrics are cast solid, and are therefore unalterable. The link is what, I presume, is called an open one, the eccentric rods being outside of the block, connecting to the valve directly, without any rock shaft. The eccentrics have 9 inches throw; but as I use it, only 5 inches throw. I get a better vacuum when well linked up, with the throttle wide open than any other way. Exhaust opens on the up stroke 7½ inches from end of stroke, and five inches from end on the down stroke. I think this is wrong, and the remedy I propose is to bore out the eccentrics on one side and put in a bushing, or piece out the valve, or close up the ports. Piecing out would make the exhaust close sooner. By crossing the eccentric rods, I should get one half inch lap instead of seven sixteenths inch lead, taking steam just as the crank pin passes the center line, cutting off and exhausting later. What would be the effect on the engine's running smoothly, and would it take more sweep of the link to handle her? What would be the effect on the vacuum, and what would a diagram of each way look like? 3. What range of stroke and pressure has a good indicator? 4. The condenser has upright composition tubes 40 inches long x ½ inch diameter, and weighing 15 ounces, taking water at the bottom and delivering on top, but to one side. The temperature of injection is 50°, and of discharge 100°, of hot well 160°. The circulating pump is 8 x 5 inches stroke, air pump 10 x 8 inches stroke, double acting, both making 120 revolutions. How can I increase the vacuum? How do you get the amount of water for a surface condenser? For a jet, Bourne gives about 29 times the amount contained in the steam. The tinning on the tubes seems to be cut away and small pin holes come. Is it the exhaust or the oil used? 5. How can I make the cut edge of belting (rubber) like the new edge? 6. How would hard wood, set in brass, do for foot and delivery valves, to work at a temperature of 160°? 7. What is the best method in the care of boilers with composition tubes? Is it not as well to feed a little salt water and blow off occasionally as to feed lime? What amount of lime is used per cubic foot of water evaporated? 8. What is the specific gravity of carbonic acid compared with fresh water? 9. Can a person prevent another from using a patent article, if he has used the same thing a number of years before the article was patented? A. 1. You have the right idea of the action of the link. 2. Probably you can secure a better action by adding lap to the exhaust side of the valve. Engines ordinarily require some cushion, whether high or low pressure. We scarcely think an alteration of the valve would affect much change in the vacuum. 3. Indicators are adapted to all strokes and steam pressures that occur in practice. 4. The trouble with your condenser seems to be that it is too small. The tubes are probably injured by some impurity in the oil. They are tinned by immersion in a tin bath. Theoretically, the amount of water required for a surface condenser can readily be calculated, and then it is customary to allow from one half to twice as much, For example, we will suppose that your engine cuts off at half stroke. Then in every revolution it uses a cylinder full of steam at 40 lbs. pressure. The capacity of the cylinder, adding 10 per cent for clearance, is about 20·5 cubic feet, so that in every revolution 20·5 × 0·13434 = 3·75 pounds of steam are used. Steam at this pressure has a total heat of 1201·5° Fah. The steam, when condensed, has a temperature of 160°, so that it has lost 1201·5° − 160° = 1041·5°, which it has imparted to the condensing water, raising the temperature of the latter 100° − 50° = 50°. Hence, in this case, if all the injection water is equally effective in condensing the steam, we shall require 1041·5 ÷ 50 = 20·83 times as much injection water as the amount contained in the steam, or 3·75 × 20·83 = 78·11 lbs. of injection water for each revolution of the engine. The circulating pump ought to be capable of delivering at least half as much more. 5. We do not think you can do it. Perhaps applying a hot iron to the edge might have a good effect. 6. The arrangement might answer. If the wood were placed endwise of the grain. 7. We know nothing of the action of lime, but do not think that, in ordinary cases, it will make any scale. Probably the best plan will be to make a slight scale in the boiler by the use of salt water. 8. About 0·00187. 9. We think you can use your arrangement, but cannot apply the improvements made by another party without first obtaining his consent.

E. L. E. says: I have a 12 inch cog wheel, gearing into a 3 inch. A crank is placed (1) on the 12 inch wheel, so as to give 5 inches leverage, or (2) so as to get 13 inches leverage, or (3) on center of 3 inch wheel What proportions have these three powers? A. Disregarding friction, the resistance that could be overcome at the circumference of the small wheel, would be as follows: 1. 3⅛ times; 2, 8⅛ times, and 3, 6 times the power applied to the crank.

J. H. asks: 1. What would be the loss of steam by having a throttle valve 25 feet from engine, with a pipe of 1½ inches inside diameter, well covered? The engine is of 10 horse power, working at 100 lbs. pressure to the square inch. 2. Were the guns on the first monitor set opposite each other, or were they set so as to fire in the same direction, having separate ports? 3. Are the guns arranged on all monitors as on the first one built? A. 1. Probably there would be no appreciable loss, under the circumstances mentioned. 2 and 3. The guns on all the monitors were arranged so that both pointed in the same direction.

P. says: I have a small printing press, which is run by a treadle. I want to know if it could be run by a weight, which could have a drop of forty or fifty feet. How heavy should such weight be? A. If it requires the power of a man to drive your press, then you will need a weight equal to one fifth of 33,000 lbs., or 6,600 lbs., raised 50 feet. This ought to drive your press 50 minutes nearly, if attached by rope and drum to your shaft.

A. M. B. says, in reply to E. R. G.'s question as to how to get the miter at the intersection of a raking with a level molding: Of course he is aware that the raking molding is of a different size and shape from the level. Draw a square of any size, and the line A B at the pitch of the cornice. Take A for a center, and C for a radius, and cut at D. Join E D, and in the angle 2



is the cut across the box; the angle 3 is for the side of box, the angle 4 is of course the miter for the level molding.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

J. W. T.—Your specimen is iron pyrites, a combination of sulphur and iron. It is used for the manufacture of oil of vitriol, and also for copperas or sulphate of iron. For the latter purpose, the ore is piled in heaps and, after roasting, is kept moistened with water. By this treatment, and the action of the oxygen of the air, the sulphur becomes oxydized to sulphuric acid, which combines with the oxide of iron, also produced, forming copperas, which is leached out with water, concentrated, and crystallized. Your grindstone material might prove of value, if its transportation to market be not too expensive.

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COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Square Acre. By J. H. M.
On Patent Cases in the Courts. By J.
On Cheap Telescopes. By S. M. B.
On Pisciculture. By J. A. M.
On Friction Pulleys. By B. N. C.
On Trisecting an Angle. By J. S. A.
On the Parabolic Mirror. By J. L.
On Reduction of Copper Ores. By F. C.
On Transfusion of Blood. By W. A. G.
On Rheumatism. By J. P.

Also enquiries from the following:
L. F.—M. F.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patens of the United States

WERE GRANTED IN THE WEEK ENDING

November 25, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Acid, making sulphuric, J. Saunders 144,928
Alarm, automatic fire, C. H. Lehnis 144,991
Anchor, Z. Hall 144,901
Animals, stock for shoeing, J. Ditch 144,963
Axles, turning carriage, W. Jones 144,908
Baking mold, G. Wingate 144,939
Balances, weighing and price, A. M. Maynard 144,914
Barrel hoop, H. Ogborn 144,920
Barrel washer, A. Muntzenberger 145,003
Bed bottom, Crosby & Cameron 144,959
Bed bottom, E. Hoyt 144,906
Bed bottom, C. B. Spencer 145,023
Bed spring, W. W. Jones 144,984
Bee hive, W. S. Hough 144,847
Beer, preserving and forcing, E. C. Krausnick 144,987
Billiard cue clamp, O. D. Benjamin 144,824
Bird cage, E. Hutchinson 144,907
Blackboard, adjustable, P. W. Moeller 144,917
Boiler, farmer's, P. Colvin 144,890
Boilers, heater and feeder for, G. C. Williams 144,937
Boot, West & Lee (r) 5,670
Boots, making wood shanks for, W. N. Sprague 145,024
Boots, etc., crimping, M. R. Marcell 144,995
Bottle, glass, Borden & Trimble 144,885
Brush, paper hanger's, J. M. McComb 144,999
Butter tubs, etc., hasp for, H. C. Carter 144,889
Caisson, A. G. Wolfgram 145,039
Car axle box, D. Muzzey 145,004
Car axle journal, J. Whitaker 145,035
Car coupling, A. F. Chandler 144,954
Car coupling, J. T. L. Cochran 144,956
Car, dumping, Elliott *et al.* 144,966
Car ticket box, G. C. Thomas 145,030
Carbureter, J. Musgrave 144,858
Carding, etc., drawing wool after, J. & J. Dobson 144,840
Caster, sewing machine, J. K. Proctor 145,011
Chair rocker, Wilcox & Depledge 145,036
Cloth, finishing nap of, J. Dobson 144,839
Clothes dryer, Burch & Webb 144,951
Clothes tongs, E. A. Foulke 144,972
Coffee pot, Weber & Knutson 144,936
Cog-tenoning machine, S. W. Long 144,992
Collar and cuff dryer, D. W. De Forest 144,838
Corn coverer, J. A. Moore 144,918
Corset, woven, J. Ottenheimer 144,921
Cultivator, L. Haverstick 144,846
Cultivator, B. W. Wingo 145,038
Cultivator, hand, A. W. Ross 144,927
Curry comb, J. W. Trussell 145,033
Curtain fixture, J. F. Wollensak 145,040
Digger, potato, A. Willmann 145,037
Drain tile, J. Leffler 144,990
Dyeing, mordant for, Burgess & La Rhett 144,952
Dynamometer, G. W. Bigelow 144,945
Earth-boring machine, S. R. Owen 145,007
Engine, rotary, Baker & McIntire 144,882
Engine, rotary, L. H. Woods 144,941
Engine, steam, A. Beekman 144,883
Engine parallel motion, etc., A. J. L. Loretz 144,852
Engine valves, actuating, F. Chase 144,881
Fertilizer, manufacture of, H. Stevens 144,877
Fire arm, breech-loading, Scott & Matthews 144,870
Fire arm, breech-loading, H. N. Sherman 144,872
Fire indicator and alarm, J. Fawcett 144,895
Fishing stake, J. O. Campbell 144,888
Flour, manufacture of, T. Carr 144,880
Forge, blacksmith's, W. T. Kellogg 144,986
Fumigator, A. R. Denlinger 144,962
Furnace, blast, F. Buttgenbach 144,829
Furnace, desulphurizing, Hegeler *et al.* 144,904
Garden-cultivating implement, D. Mack 144,912
Gas carbureting apparatus, A. W. Porter 144,863
Gas manufacture, H. Skoines 145,021
Gas meter, paper dry, Schüssler & Dieterich 144,868
Gas pipes, clearing, Goldsmith *et al.* 144,843
Gas retort mouth piece, P. Munzinger 144,857
Gate, farm, W. Lucus 144,994
Governors, safety appliance for, J. Gaskell 144,973
Grain scourer, C. B. Horton 144,980
Grain separator, S. Day 144,836
Grape and flower picker, C. W. H. Delano 144,837
Grass, cutting flower maker's, T. & J. Millot 144,916
Grindstone wetting device, D. Cumming, Jr 144,891
Hammer, tack, G. J. Capewell 144,953
Hammers, machine for forging, W. Evans 144,969
Harness pad, S. A. Marker 144,853
Harness safety strap, C. W. Nichols 145,006
Harrow, L. C. Rumberger 145,016
Harrow, circular, G. W. Hills 144,978
Hat conformator, J. J. McKnight 144,855
Heel stiffeners, making, J. Samuels 145,017
Hinge, blind, L. Gathmann 144,898
Hinge, shutter, W. Fosket 144,971
Hog ringing pincers, J. C. Schoettle 144,867
Horseshoe, R. F. Cooke 144,883
Horseshoe nails, finishing, S. S. Putnam 144,922
Hose coupling, T. J. Mayall 144,997
Hose coupling spanner, L. Pond 144,862
Hose pipes, stop nozzle for, J. N. Allen 144,942
Indicator, pneumatic, Kealy & Rigney 144,909
Ingots for alloy, copper, J. Feix 144,896
Inkstand, B. Brower 144,825
Inkstand, T. S. Shenston 144,929
Iron finery fire, Ash & Walker 144,821
Ironing machine, J. F. Walker 145,034
Jack, lifting, Hamilton & Conner 144,977
Knit fabric, B J. McGee 144,915
Ladder, fireman's, M. Cronin 144,958
Last block fastener, N. R. Streeter 145,028
Laster, shank, W. H. Hanna 144,903
Latch, door, F. Stowe 144,931
Latch, gate, J. Bull (r) 5,668
Leather splitting machine, Goebel & Preis 144,899
Letter box, B. B. Gurley 144,976
Locomotive smoke stack, J. V. Bishop 144,884
Lubricating compound, N. D. Smith 144,875
Malt polishing apparatus, W. W. Stoll 145,027
Measurer, spooling machine, Keith & Seaver 144,985
Medical compound, G. F. Munro 145,002
Milk cooler, Crane & Hadley 144,835
Mill, fulling, R. Eickemeyer 144,841
Millstone dressing machine, diamond, D. Laver 144,851
Mop wringer, A. W. Bunnell 144,828
Nail machine, cut, W. Haddock 144,845
Needle threader, F. R. Gaspary 144,974
Nut lock, W. H. Bowman 144,856
Nut lock, C. Dittman 144,964
Nut lock, C. A. Howard 144,905
Oil cabinet, T. Miller 144,856
Oven for plate glass, flattening, J. B. Boulicault 144,946
Pail, folding, Du Chateau & Williams 144,893
Paint, manufacture of, F. W. Gerdes (r) 5,669
Paper machines, stuff regulator for, D. Hamel 144,902
Photographic plate holder, A. Semmendinger 145,020
Piano string bridge, W. C. Ellis 144,842
Pipe coupling, D. Ashworth 144,943
Plane, metallic, J. F. Baldwin 144,823
Planing machine, J. Rankin 145,012
Planter, corn, J. G. La Fonte 144,989
Planter, hand corn, M. P. Nemmers 144,919
Plow, A. K. Dahl 144,960
Plow, steam, Allen, Browen & Moulthrop 144,820
Plug, testing, J. Allin 144,881
Power, spring, T. Ebeling 141,894
Press, hand power baling, P. C. Ingersoll 144,982
Printing press, feeding, J. T. Ashley 144,822
Printing enameled surfaces, S. J. Hoggson 144,979
Propellers, operating screw, A. McDonald 145,000
Pump, J. W. Douglass 144,965
Pump valve, Gould & Campfield 144,844
Purifier, middlings, E. N. Lacroix 144,988
Quicksilver, purifying, Randol & Wright 144,923
Radiator, steam, A. L. Ide 144,981
Railway frog, J. Wood 145,041
Railway rail fastening, A. M. Rouse 145,015
Railway switch, T. J. Reynolds 145,013
Railway switch, W. A. Slingerland 144,930
Railway switches, operating, J. Wood 144,880
Railway switch, self-closing, Hubbell & Gregory 144,848
Rake, horse hay, G. Sweet 145,029
Refining and desilvering lead, G. Luce 144,993
Register for machinery, S. F. Payne 144,861
Rubber, etc., compounds of, T. J. Mayall 144,998
Saddle, T. H. McGrath 145,001
Safe doors, operating, H. B. Tripp 145,032
Sample case, revolving, J. F. Randolph 144,914
Sap spout, H. B. Sevey 144,871
Saw mill dog, E. H. Stearns 145,026
Saw mill dog, J. Torrent 145,031
Saw mill head block, Prescott *et al.* 144,866
Saw set, W. J. Boynton 144,947
Scraper, road, R. F. Read 144,925
Scraper, road, Warner & Kingsley 144,935
Seeder, broadcast, J. R. Scarborough 145,018
Seeding machine, M. Schnapp 145,019
Seeding machine, E. Witzigman 144,879
Sewer bottom, cement, M. Day 144,961
Sewing machine, D. Porter 144,864
Sewing machine, O. St. Amant 145,025
Sewing machine caster, J. K. Proctor 145,011
Sewing machine extension table, J. Bennor, (r). 5,667
Shovel, sifting, C. Kaestner 144,850
Signal, fog, G. C. Pattison 145,008
Signal, railway, E. R. Marshall 144,854
Skirt, skeleton, P. Lippmann 144,911
Sleigh brake, T. H. Bromley 144,949
Smoke consuming apparatus, W. B. W. Smith 145,022
Soda water tumbler holder, J. Matthews 144,913
Spark arrester, G. Swenson 144,932
Spinning machine spindle, W. G. Perry 145,009
Spoke setting machine, W. R. Greene 144,900
Spring, door, F. H. Richards 144,926
Steel, manufacture of, C. M. Nes 145,005
Stoner, cherry, Buck & Kirk 144,887
Stove pipe stretcher, etc., G. Elsey 144,967
Strap coupling, T. Cogswell 144,957
Stubble shaver and scraper, Von Phul, Jr. *et al.* 144,933
Sulky, L. H. Jennison 144,983
Suspenders, T. J. Flagg 144,970
Table, ironing, L. Scofield 144,869
Tablet, writing, C. N. Brown 144,950
Tan drying apparatus, N. Porter 145,010
Thrashing machine, J. Smith 144,874
Toy, automatic, A. H. Dean 144,892
Trap, fly, Packard & Standish 144,860
Truss, brace, H. H. Roedel 145,014
Umbrella, H. L. Power 144,865
Umbrella, C. B. Spencer 144,876
Valises, etc., connecting frames of, C. Votti 144,878
Valve, A. Marriott 144,996
Varnish, refining, F. Kersting 144,910
Varnish for wood, metal, etc., J. F. Chevalier 144,955
Veneer cutting machine, W. H. Williams 144,938
Vessels' booms, antifriction, H. Gregory, Jr 144,975
Vessels, center board for, J. Espalla 144,968
Vise, adjustable bench, J. B. Wardwell 144,934
Wagon brake, E. N. Jack 144,849
Watch, stem winding and setting, E. J. Pacaud 144,859
Watches, reversible center pinion for, O. Gates 144,897
Water tank for hotels, J. H. Corey 144,834
Water wheel, B. J. Barber 144,944
Whiffletree, D. S. Sloan 144,873
Wire-drawing machine, J. & E. Woods 144,940
Wood, compound for filling, C. E. Bradley 144,948
Wrench, T. L. Buckley 144,826
Wrench bars, die for forging, L. Coes 144,832
Wrench, hose, E. Bucklin, Jr 144,827

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

27,297.—RAILROAD CAR COUCH.—E. C. Knight. Feb. 11.
27,303.—FASTENING SAW HANDLES.—J. Neimeyer. Feb. 11.

EXTENSIONS GRANTED.

26,243.—WATER CLOSET BASIN.—W. Boch, Sr.
26,262.—JOURNAL BOX.—W. M. Ferry, Jr.
26,276.—INDIA RUBBER HOSE.—T. J. Mayall.
26,321.—METAL CASTING MOLD.—J. P. Broadmeadow.
26,327.—NURSING BOTTLE.—F. J. La Ferme.
26,329.—BOOT TIP.—N. Silverthorn.

DESIGNS PATENTED.

7,002.—KNIFE HANDLE.—J. D. Frary, New Britain, Conn.
7,003.—INKSTAND.—G. W. McGill, New York city.
7,004.—ORNAMENTAL MAT.—L. Moeslein, New York city.

TRADE MARKS REGISTERED.

1,537.—EMERY.—Abbott & Howard, Boston, Mass.
1,538.—GUANO.—Guanahani Guano Co., Petersburg, Va.
1,539.—PLOWS.—Hunter & Co., Fredericksburg, Va.
1,540.—PERFUMERY, ETC.—Felix Prot & Co., Paris, France.
1,541.—CIGARS.—T. B. Slingerland, Rome, N. Y.
1,542.—CIGARS, ETC.—Consolidated Tobacco Co., Gilroy, Cal.
1,543.—TEAS, ETC.—Great Eastern Tea Co., Terre Haute, Ind.
1,544.—ORGANS.—G. Woods & Co., Cambridgeport, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade Mark $25
On filing each application for a Patent (17 years) ..$15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On application for Extension of Patent $50
On granting the Extension $50
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA FROM NOVEMBER 25 TO DECEMBER 5, 1873.

2,884.—T. W. Perry, Ringwood village, York county, Ontario. Composition of matter for a table sauce, called "Perry's Indian Chutney Sauce." Nov. 25, 1873.
2,885.—I. K. Proctor, Salem, Essex county, Mass., U. S., assignee of J. K. Proctor, Malden, Middlesex county, Mass., U. S. Improvement for sewing machine tables or stands, etc., called "Proctor's Caster Attachment for Sewing Machine Table, etc." Nov. 25, 1873.
2,886.—D. Saul, New Edinburgh, Carleton county, Ontario. Improvement in hoisting machine, called "Saul's Improved Hoisting Machine." Nov. 25, 1873.
2,887.—W. M. Rice and A. D. Cable, Montreal, P. Q. Improvement in laying the permanent way of railways, called "Rice's Cushioned Rail." Nov. 25, 1873.
2,888.—T. Paxton, Wm. Tate and C. Paxton, Fort Perry, Ontario county, Ontario, assignees of Wm. Dunn, same place. Machine for attaching to or connecting with gang plows, called "Dunn's Improvement on Gang Plows." Nov. 25, 1873.
2,889.—J. C. Schoonmaker, Kansas City, Jackson county, Mo., U. S. Improvement on lightning rods, called "Schoonmaker's Insurance Lightning Rod." Nov. 28, 1873.
2,890.—W. W. Weaver, New Haven, Oswego county, N. Y., U. S. Improvement on turbine wheels, called "Weaver's Volute Chute Turbine." Nov. 28, 1873.
2,891.—J. G. Loggins and T. P. Wilkins, Williston, Chittenden county, Vt., U. S. Improvement on machine for cutting the notch in wooden hoops for barrels, etc., called "The Hoop Locker." Nov. 28, 1873.
2,892.—C. Campbell, Montreal, P. Q., and J. A. Laemle, Staten Island, U. S. Improvement on printer's furniture, called "Campbell's Improved Printer's Furniture." Nov. 28, 1873.
2,893.—Honorable H. Aylmer, Melbourne, District of St. Francis, P. Q. Improvement on machine for cutting clapboards, called "Aylmer's Clapboard Machine." Nov. 28, 1873.
2,894.—G. Boucher de Boucherville, P. Q. *Nouvelles maniere de se servir des lames pour propulser le navires, "Lame Moteur."* Nov. 28, 1873. Improvement in "new paddles for propelling vessels."
2,895.—J. C. Livermore, Boston, U. S. Improvement on skirt protectors, called "The Oracoline or Dayton Skirt Protector." Nov. 28, 1873.
2,896.—H. Parker, Gananogue, Leeds county, Ontario. Improvement in the art or process of molding cores and mold employed for casting the cores by such improved process, called "Parker's Improved Process and Mold for Casting Cores." Nov. 28, 1873.
2,897.—J. P. Bass, Bangor, Penobscot, Me., U. S., assignee of H. C. Bucknam, Bricksport, Hancock county, Me., U. S. Improvement on the process or method of cleaning surface condensers, called "Bucknam's Process for Cleaning Surface Condensers." Nov. 28, 1873.
2,898.—F. H. Perry, Drummondville, Welland county, Ontario. Machine for washing textile fabrics, called "Perry's Hydraulic Washer." Nov. 28, 1873.
2,899.—Wm. C. Sillar, No. 1 St. Swithin's Lane, London, Eng., R. G. Sillar, Lee, Kent county, Eng., and C. Rawson, No. 1 St. Swithin's Lane, London, Eng. Improvement on deodorizing, purifying and utilizing sewage, night soil, excreta and excrementitious and refuse matters, called "The Native Guano Company's Improvement on Deodorizing, Purifying and Utilizing Sewage, Urine, Night Soil, Excreta and Excremetitious and Refuse Matters." Dec. 5, 1873.
2,900.—S. Standish, Eureka, Lauder county, Nevada, U.S. Improvement on Brooms, called "Standish's Broom." Dec. 5, 1873.
2,901.—C. Stoner, Montreal, P. Q., assignee of I. Fisher, Boston, Mass., U. S. Improvement on mechanism for lighting gas burners, called "Fisher's Automatic Gas Lighter." Dec. 5, 1873.
2,902.—E. Moncau, San Francisco, Cal., U. S. Improvement on sewing machine, chiefly designed for embroidering and stitching button holes, called "The Eureka Button Hole Sewing Machine." Dec. 5, 1873.
2,903.—T. Baty, Westminster township, Middlesex county, Ontario. Useful fence, called "Baty's Farm Fence." Dec. 5, 1873.
2,904.—I. Fréchette, St. Hyacinthe, P. Q. *Ameliorations aux rateaux de moissonneuses*, called "*Rateaux de Moissonneuses Ameliorees.*" Dec. 5, 1873. Improvement on rakes for mowing machines.
2,905.—D. Heaton, Providence, R. I., U. S. Improvement in combination tools, called "The Imp." Dec. 5, 1873.
2,906.—F. Rogers, Lynn, Essex county, Mass., U. S. Improvement on the manufacture of shoes, called "Rogers' Improved Shoe." Dec. 5, 1873.
2,907.—J. L. and D. H. Coles, New York city, U. S. Improvements on sewing machines, called "Cole's Universal Feed Sewing Machine." Dec. 5, 1873.
2,908.—J. Miller, Perth, Lanark county, Ontario. Improvement on sewing machines, called "The Miller Sewing Machine." Dec. 5, 1873.
2,909.—J. H. Copping, Toronto, Ontario. Improvement on a machine for the rolling, printing and cutting of lozenges, called "Copping's Improvements on Lozenge machine." Dec. 5, 1873.
2,910.—H. J. Davies, Brooklyn, Kings county, N. Y., U. S. Improvements on machines for printing and embossing skirts and other articles, called "Davies' Machine for Printing and Embossing Skirts." Dec. 5, 1873.
2,911.—H. F. Knapp, New York, U. S. Improvements o means for raising and floating wrecks and sunken vessels, called "Knapp's Improved Means for Raising and Floating Wrecks." Dec. 5, 1873.
2,912.—J. Varney, Montreal. Improvement on washing machine, called "Varney's Washing Machine." Dec. 5, 1873.
2,913.—D. S. McKinnon, Carleton Place, Lanark county Ont. Improvement in sewing machine stands and covers, called "Mack's Sewing Machine Stand." Dec. 5, 1873.
2,914.—P. D. Cummings, M. Smith and J. C. Jordan, all of Portland, Maine, U. S. Improvement in match slitting machine, called "Cummings, Smith and Jordan's Match Slitting Machine." Dec. 5, 1873.
2,915.—T. A. Heintzmann, Toronto, Ont. Improvement on pianofortes, called "Heintzmann's Improved Bridge." Dec. 5, 1873.
2,916.—W. M. Fuller, New York, U. S. Improvement on heating apparatus, called "Fuller's Improved Heating Apparatus." Dec. 5, 1873.
2,917.—M. Thibault, Hull, Ottawa county, P. Q, and S. Benoit, of Ottawa, Carleton county, Ont. Improvement on machine for cutting nails, called "Thibault's Improved Nail Cutter." Dec. 5, 1873.
2,918.—D. M. Lamb, Strathroy, Middlesex county, Ont. Improvement on filters for oil and other liquids, called "Lamb's Combined Oil Filter." Dec. 5, 1873.
2,919.—D. M. Lamb, Strathroy, Middlesex county, Ont. Manufacturing and treating vulcanizable gum and hydrocarbon oils, called "Lamb's Gum and Oil Process." Dec. 5, 1873.
2,920.—D. M. Lamb, Strathroy, Middlesex county, Ont. Compound vulcanizable gum, called "Lamb's Vulcanizable Waterproof Gum." Dec. 5, 1873.

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Patents and Caveats
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PATENTS are now granted to inventors in Canada, without distinction as to the nationality of the applicant. The proceedings to obtain patents in Canada are nearly the same as in the United States. The applicant is required to furnish a model, with specification and drawings in duplicate. It is also necessary for him to sign and make affidavit to the originality of the invention.

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HOW TO OBTAIN PATENTS

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

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The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawing and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

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INDEX.

ILLUSTRATIONS.

A

Air engine, the hot 37
Albino robin, an 386
Amazons, the mouth of the 244
Ant, the honey-making 180
Aquarium, the Brighton 375

B

Balloon, M. de Lome's great 55
Balloon, the great transatlantic 159, 177
Balloon valve 164
Bath, Turkish 52
Beehive, life in the 3
Beetle, the common 18
Blast furnace, Büttgenbach's 179
Boat-detaching apparatus, Enell's 182
Bolt-forging machines, Abbe's 86
Boring machine, Bentel & Co's. 390
Box cornering and grooving machine, Davis' 358
Brain, the mechanics of the 224
Brick compressing machine, Large's 134
Bricks, improvement in 66
Bridge at St. Louis, the great 311
Bridge, lifting, Browne's 151
Bunsen, Robert Wilhelm 39
Butter, manufacture of artificial 246

C

Caloric engine valves 149
Canals, concrete siphons for 130
Cannon of olden times 18
Car axle, the standard 211
Car brake, Crowe's 242
Car brake, hand, Foster's 198
Car coupler, Inge & Co 's 54
Car coupling, Howard's 278
Car coupling, Lloyd's 295
Car, dumping, Peters' 22
Checker lozenge package, Booth's 226
Cheese skipper exterminator, Green's 83
Churn, Holdam's 102
Churning apparatus, Ridler's 338
Cigar box, revenue, Wiley's 118
Cocuyo, the 375
Coffee pot, Stubbings' 386
Collar brace, horse, Batwell's 38
Color of water, accidental 322
Colors, exhibiting the combination of 152
Compress, standard, Grader's 287
Condensing the liquefiable matters in gas, Pelouze and Audouin's method of 292
Conservatory, design for a cool 391
Cooking, heating, and drying apparatus, combined, Boswell's 390
Corn sheller, bootjack, etc., Iske's 310
Cot, perambulating, Richards' 118
Cotton chopper and cultivator, Underwood's 134
Cow, "Duchess of Oneida," the 263
Cradle and rocking chair, combined, Hambugers' 70
Crane, steam, Wilson & Co.'s 323
Crane, steam, Appleby's 95
Crawfish, fresh water 141
Crawshay, Mr. Robert 370
Cultivator, Krogh's 38
Cut-off, variable, Cross' 223

D

Dentristy, a device in 18
Derrick, the large floating 162
Devil fish, the 131
Diamond cutting in New York, 207, 215
Diffraction phenomena, the projection of 324
Dipper, the Jackson 325
Dog, log, Brown's 310
Donaldson, Washington H 159
Dover, England, the town and harbor of 290
Down Hall, near Harlow, England 199
Dredging apparatus, deep sea 178
Drill chuck, Reid's 214
Drill chuck, self-tightening, Hubbard and Curtiss 211
Drill, clutch, Gill's 199

E

Earwigs 195
Echoes in buildings 355
Electric light, Gramme's 351
Electric light, new 40
Emery grinder, the Tanite Co.'s. 22
Emptying vaults and removing soil, apparatus for 255
Engine, the Challenge reversible rotary 375
Engine, the K. M. I. steam 335
Engine, three cylinder, Brotherhood & Co.'s 291
Engine turning with the American chuck 309
Evaporation by plants, the 227

F

Fan, the first automatic 119
Feeding and watering cattle in transit, Bonser's system of 274
Feed water heater and purifier, France's 143
Fertilizers from offal, making, Storer's process 179
Fire escape, Merritt & Switzer's. 38
Fish, Chinese fresh water 407
Fishing roo, Smith's 98
Flax-breaking machine, Brasier's 371
Flowers by insects, fecundation of 243
Fluorescence, Professor Morton on 82, 83
Fountain, public drinking 63
Fountain, table, the American Fountain Works' 406
Friction attachment, Cox's 150
Fuel, artificial, Loiseau's 319
Furnace, heating, Abbott's 295

G

Gas lighter, electric 35
Gas manufacture, an improvement in 307
Gate, farm, Gillespie's 6
Ghost, Pepper's 395
Gillott, the late Joseph 271
Governor, Gardner's 50
Governor, turbine, Terhune's 342
Gravity indicator, specific 35
Gymnast, toy, Bancker's 406

H

Hammer, power spring, Palmer's 262
Harkort, John Kaspar 147
Hatchet, claw, Weaver's 38
Hay rake and tedder, combined, Colvin's 230
Heel plate, boot, Massey's 38
Herons and cranes, Japanese 103
Hub lathe, Rickart's 6
Hull Dock Company's new offices, the 387
Hulling stone, Bertelson's 150

I

Ice and refrigerating machine, Windhausen's 79

J

Journal box, Crawford's 152
Journal box, Elms' 275

K

Kansas City exposition, building for the 151

L

Lamp, automatic taper 402
Lathe, an ancient 274
Lathing, fireproof, Holmes' 326
Launch Firefly, steam, Thorneycroft's 258
Liebig, Baron Justus von 71
Life boat tent attachment, Adams' 294
Life buoys, inextinguishable fire for 258
Lifting jack, Snively's 2
Lighthouse at Race Rock, Long Island 306
Lighthouse at the Thimble Shoal, Va 306
Locomotive, articulated 135
Locomotive for plowing, road, Aveling & Porter's 15

M

Magic lantern as a means of demonstration, the 163, 184, 200
Magnet, Jamin's 383
Mansion and museum, Mrs. Bowes' 327
Mars, the hemispheres of 195
Mars, the planet 210
Match safe, gas bracket, Orum's. 342
Measuring rod and dividers, combined, Discher's 406
Measuring wheel, Way's 343
Mentone, the fossil man of 243
Milk refrigerator, Lawrence's 83
Mill pick, Cummings' 278
Moistening device for lame animals, Harris' 406
Mold, ramming the 322
Mole trap, Becker's 178
Moth, the Acorn 51
Moth, the Great Leopard 96
Moth, the Isabella Tiger 51
Motor, domestic, Meyer's 118
Mowing machine, ancient 2
Mowing, reaping, and thrashing machine, Cumming's 35

N

Needle and a wasp sting, a 131

O

Ox bow, Moore's 66
Ozone generator, Tisley's 167

P

Palm of Brazil, the *pashiuba* 259
Palm, the *oreodoxa regia* 371
Paper feeding machine, Baker & Schofield's 98
Pardee Hall and its founder 339
Peat-compressing machine, Clayton & Co.'s 1
Peripolar induction apparatus, Le Roux's 259
Permeator, self-feeding, Hamilton's 279
Pigeon, the mechanical 18
Pig feeder, McElrath & Houghton's 66
Pinchers, shoemaker's, Hanna's. 232
Pipe coupling, Dunning's 374
Plane, match, Edwards' 231
Planetary motion 275
Plaster of Paris, the manufacture of 399
Plate-bending machine 34
Plow attachment, Donnelly's 214
Plumbing, careless 403
Press for fruit, etc., Harlan's 260
Propeller, chain, Neumann's 70
Propeller, helicoidal, Patterson's 263
Propeller, Hubbard's 66
Propeller, hydraulic, Boy's 166
Pulleys, elliptic 308
Pulsometer or steam pump, Hall's 127
Pump, centrifugal, Marquis Brothers' 402
Pump, double acting steam, Wright's 88
Pump for raising sewage, air 99

R

Railroad gate and signal, Walker's 214
Railway, hillside, Du Bois' 239
Railway, the Rigi 194
Railway, wire rope, Haven's. 191
Rectifying spirits, apparatus for, Ackerman's 374
Reversing gear for rolling mills, Reichenbach's 130
Roller and irrigator, combined, Howard's 230
Russell, John Scott 147

S

Sash cord fastener, Harris & Hewitt's 115
Sash fastener, Demming's 259
Sash lock and weather strip, combined, Sprague's 226
Saw, planer-toothed, Emerson's. 294
Saw swage, Emerson's 294
Sewer gas trap, Anthon's 326
Sewers, ventilation of 232
Sewing machine, the ancient 260
Sewing machine tucking attachment, Bouillon's 70
Sheep shears, the lightning 310
Ship construction, composite 23
Ships, circular 275
Silkworm and moth, the Cecropia 87
Silkworm, the Pernyi 67
Slicer, fruit, etc., Vibert's 294
Snow and earth shovel and plow, combined, Baker's 374
Sophora of Japan, the weeping. 402
Sounding instruments, deep sea 4, 21, 243
Spade and fork, combined, Stone's 198
Steam engine, compound, Field & Cotton's 19
Steam engine, portable, Cooper's 119
Steam engine, rotary, Jones' 47
Steam engines for torpedo boat .. 129
Steam gage, Hayward & Son's 231
Steam motor, Siemens' 194
Stereoscope for large pictures, Winstanley's 231
Stove, ventilating, Salmon's 54
Subways, Holborn viaduct 303
Sugar-making process, Aschenbrenner's 367
Sun dial, how to draw a 409
Swans, South American black necked 343
Switch, railroad, Adams' 262

T

Telegraph cable damaged by sawfish 34
Telegraph carriage, postal 323
Telegraph poles, metallic, McCarver & Co.'s 35
Telegraph, the miniature 354
Telegraph, the Tom Thumb 354
Testing machine, Michele & Carrington's 152
Tool, combination, Whitehead's. 339
Tool holder for slide rest 67
Torch, Bartholomew's 338
Torpedo, Lay's 31
Torpedo, Porter's 31
Trade mark decision, a 342
Transferring motion, device for, Benson's 182
Trap, animal, Barr's 243
Tree protector, a simple 210
Turbine wheel, Craik's 166

V

Ventilator, screw car, Schopp's .. 86
Venus, an automaton transit of .. 403
Vienna exposition, the great machinery hall at the 146
Vienna exposition, the Japanese department at the 279
Vienna exposition, the Persian pavilion at the 167
Vienna exposition, the Turkish pavilion at the 183
Vitriol, manufacture of oil of ... 111, 114, 115

W

Washer, steam, Davidson & Co.'s 98
Water and pressure gage, combined, Brown's 198
Water closet, odorless, Rowe's .. 102
Water cooler, Mexican 275
Weather strip, Potter's 150
Wheels, railway, Ludwig's 19
Wise, John 159
Wood-boring machine, Richards' 226
Wrench, Post's 150

Y

Yucca pendula, the 358

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Accident, shocking 115
Acid, a new 20
Advertisers, rare chance to 264
Aeronaut La Mountain, death of the 56
African discovery, important 65
Agassiz, Professor 401
Air by vapors, defilement of 329
Air in cars, pure 190
Alaska, penal settlement in 19
Albinism among birds *386
Albumen from milk 113
Alcohol in bread 6
Alcohol in fusel oil 104
Alcohol, testing 279
Alloys of nickel, etc 66
Aluminum, electro-deposit of 97
Amalgamating battery zincs 43
Amazon river, new exploration of the 209
Amazons, up the—Letters from Professor Orton. 228, *244, 280, 296
American Academy of Sciences 209, 328
American Association for the Advancement of Science. 153, *168, 185
American Institute, fair of the 194, 209, 225, 241
American inventions abroad 153
American railway traveling 377
American scientific schools 226
America, the discovery of 119
Ammonia salts, preparing 354
Ancient construction 72
Aniline black 39
Aniline black, printing with 232
Aniline brown, a new 161
Aniline colors, mordants for .. 17, 164
Aniline red, new 49
Annealing 303
Answers to correspondents .. 11, 27, 43, 59, 75, 91, 107, 123, 138, 153, 171, 187, 203, 219, 234, 250, 266, 282, 299, 315, 331, 347, 363, 379, 395, 409
Antiseptic substances and virus. 337
Ant of Mexico, the honey-making *180
Apprentices, a word to 216
Aquarium, the Brighton *375
Arctic expedition begun, another 64
Arctic expedition, new 295
Arctic expedition, the recent 17
Arctic explorers, the missing 193
Arctic regions 181
Arcturus, the star 360
Arsenical colors, test for 257
Arsenic in hydrophobia 391
Asbestos piston packing 182
Asphaltum, American 137
Astronomical notes 5, 299, 360
Astronomy, a great "lick" in 320
Astronomy in the United States. 88
Astronomy, the base line of 112
Atlantic cable, laying the fifth ... 21
Atlantic cable, the new 19
Atmosphere, hight of the 180
Atmosphere, westward movement of the ..... * 68
Atmospheric railway in London, the 404
Auroral phenomenon 49
Austrian farmer's entertainment, an 64
Austrian railway cars 67
Award, a just 241

B

Babbitt metal 364
Balloon, a metal 211
Balloon and the aeronauts, the ... *159
Balloon, another Atlantic 345
Balloonaria 153
Ballooning, perils of 69
Balloonists, a suggestion for 149
Balloons, great ..... * 55
Balloon, the voyage of the *Graphic* *176
Balloon to Europe, failure of the 193
Balloon, to Europe in a 33, 49
Balloon to Europe, second failure of the 256
Balloon valves *164
Balloon voyage, the proposed 37
Balloon voyage to Europe 160
Bath, new Turkish ..... * 52
Baths, sand and mud 224
Batteries, Ladd & Co.'s 322
Bay rum 363
Beehive, life in the ..... * 3
Bees as architects 245
Bee stings, cure for 117
Beetle, the common ..... * 18
Bell cord, substitute for the 66
Benzine, qualitative analysis of. 344
Better times 368
Birds, Japanese *103
Birds, sagacity of 344
Bisulphide of carbon auxiliary, the 144
Burrs from heating 198
Blackbird, a white 260
Blast furnaces, new system of *179
Bleaching grass, etc 123
Bleaching sponge 315
Blue, a new 130
Boat detaching apparatus *182
Boiler, criminal treatment of a.. 169
Boiler experiments, steam 68
Boiler explosion 337
Boiler explosions 183
Boiler explosions, the causes of.. 101
Boilers and boiler owners 32, 116
Boilers, cork jackets for 183
Boilers, factor of safety for 193
Boilers, preventing incrustation in 4
Boilers, steel 49
Boiler, steel locomotive 8
Boilers, testing steam 101
Boiler tests at Sandy Hook 323
Boiler tests, the government 305
Boils, cure for 108
Bolt forging machine ..... * 86
Bolt forging machine *199
Bones into fertilizers, converting 193
Boots, squeaking 118
Borax in California 152
Boring machine, universal *390
Boring machine, wood *226
Boston rebuilt 336
Box corner grooving machine *358
Boys! what shall we do with our Brain, the 185
Brain, the mechanics of the *224
Brass castings, dip for 282
Brick compressing machine *134
Bricks, improvement in ..... * 66
Bridge across the Niagara river .. 339
British Association, the 273
Bridge at St. Louis, the great *311
Bridge, counterbalanced lifting .. *151
Bridgeport factories, the 276
Bridge, the Niagara river 321
British Association, meeting of the 264
British Association, the 21
Bronze powder 395
Bronzing brass 331
Bronzing iron 208
Browning brass 364
Browning steel 364
Bunsen, Robert Wilhelm ..... * 39
Butter and cheese exchange, a ... 199
Butter and churning, curiosities of 257
Butter and fats 118
Butter, artificial 240, *246
Butter, Creole plan of making 266

C

Cables, the Atlantic 277
Cable, the Brazilian 226
Cable, the transatlantic 129
Cabs, progress of 80
Caffein, physiological properties of 405
California woodchoppers 376
Camphor 136, 208
Canal boat trials, Erie 281
Canals, steam power on the 72
Canal, the Corinth ship 353
Canal, the Southern 24
Cancer by pressure and iron, treating 388
Cane and eye glass, combined 364
Cannon ball, a floating 4
Cannon curiosity, a ..... * 18
Cannon, new and remarkable 216
Cannon, revolver 69
Cañon of Colorado, the great 21
Caoutchouc from common plants 256
Caoutchouc, new derivatives from 369
Caoutchouc, where it comes from, etc 145
Capillarity, a phenomenon of 354
Carbolic acid 235, 241
Carbonic acid in wells 292
Car brake, improved *242
Car coupler, automatic ..... * 54
Car coupling *295
Car coupling, automatic *278
Carpets, cleaning 123
Carpets, restoring colors of 138
Car seats, uncomfortable 182
Car starter, a new 323
Car ventilator, screw ..... * 86
Car wheels, paper 325
Case-hardening iron 315
Cattle cars, reward for improved 373
Cattle on railroads, feeding and watering *274
Caustic soda, preparing 262
Cement for making concrete 213
Cement for mica 139
Cement for pipes, stills, etc 340
Cement for wood vessels 377
Cementing metal to glass 118
Centennial exhibition, the 322
Centennial, New York and the ... 353
Chalk crayons 107
Charcoal for preserving poultry. 71
Checker lozenge package *226
Cheese, a mammoth 358
Cheese skipper exterminator ..... * 83
Chemists, experiments for young 308
Chicago, the new hotels of 66
Chimney fall? what made the 338
Chimneys, concrete 39
Chimneys, down draft in 389
Chinese and the newspapers, the 167
Chinese physiology 375
Chlorate of potash, manufacture of 113
Chloride of iron by dialysis 242
Chloroform, preparing 395
Chloroform, the deep injection of 344
Chlorophyll, preparation of pure 247
Cholera mixture, the *Sun* 20
Cholera, new remedies for 354
Chromic acid, new method for 386
Chuck, drill *211
Chuck, the Danbury drill *214
Chuck, the Victor 231
Churn, improved *102
Churning apparatus *388
Cigar box, the revenue *118
City of Washington, loss of the .. 54
Clarifying beer 95
Clock of Trinity church, N. Y., the 130
Clocks and chimes, church 216
Cleveland, a grand medal for 169
Clutch drill *199
Coal beds, burning 230
Coal-cutting machinery 273
Coal fields, the Chinese 352
Coal in South Africa 355
Coal mining by compressed air .. 168
Coals used for gas 273
Coal tar interest, the 384
Cobalt compounds, poisonous ... 129
Cocuyo, the 306, *375
Coffee pot, improved *386
Collar brace, horse ..... * 38
Collodion 251
Coloring wax 331
Color of bodies of water, accidental *322
Colors, photometry of 325
Color, to restore 132
Comet, Biela's 21
Comets, new 339
Comets, the tails of *117
Compasses, location of standard 118
Compass in iron vessels, the 182
Compress, standard 287
Concrete for building purposes .. 80
Concrete foundations 295
Conservatory, design for a *391
Cooking, heating, and drying apparatus, combined *390
Copper and tin, tests for 251
Copper ores, reduction of 327
Copper spring, a remarkable 404
Cornell university 57
Corn sheller, bootjack, etc *310
Corn shuck, a fossil 49
Correspondents, our 338
Cot, perambulating 118
Cotton chopper and cultivator .. *134
Cotton press, a gigantic 289
Cotton thread, variegated 338
Cotton window in the Guildhall, London, the 335
Couplings, self-acting railway 162
Cow, a forty thousand dollar *263
Cow, the Ayrshire 313
Crackers, medicated 49
Cradle and rocking chair ..... * 70
Crane, a large steam ..... * 95
Cranes at Vienna, steam *323
Crank pins for steam engines 198
Crank pins, the proper length of. 276
Crawfish, fresh water *131
Crisis, the financial 224

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Crith, the ... 379
Crops, the ... 40
Cultivator, farm ... * 38
Cumberland Gap cave ... 169, 217
Cupro-ammonium ... 234
Currency in Liberia ... 41
Cut-off, variable ... *223
Cuttle fish, huge ... 402

D

Dead, preserving the ... 22
Decimal measures, new basis for ... 259
Delaware Water Gap cave ... 276
Dentistry, a device in ... *18
Deodorizing process for offal ... *179
Deodorizing the offal from slaughterhouses ... 177
Derrick, the large floating ... *162
Devil fish, a large ... 194
Devil fish, the ... *131, 147, 196, 263
Dextrin, gum ... 251
Diamond cutting in New York ... *207, 215
Diamonds, recent experiments with ... 353
Diffraction phenomena, the projection of ... *324
Digestive apparatus, the ... 16
Dikes on the Seine ... 242
Dipper, the Jackson ... *326
Discoveries, two interesting ... 272
Ditching by steam power ... 258
Docks, accident to the new ... *161
Dog, frost log ... *310
Dover, England, the town and harbor of ... *291
Down Hall, near Harlow, England *199
Drafting instrument, a valuable ... 254
Dredging apparatus, deep sea ... *178
Drill, the Burleigh rock ... 264
Dryer for oils, etc ... 340
Dumping car, portable ... *22
Dyeing recipes, new ... 405
Dyspepsia, about ... 339

E

Ear, injuries of the ... 152
Earth, diurnal movement of the ... 84
Earthquake in Panama ... 322
Earthquakes at Naples ... 209
Earth's interior, the condition of the ... 54
Earwigs ... *195
Easterly current, that ... 305
Eating, regular ... 312
Echo checked by wires ... 306
Echoes in buildings ... *356
Eight hour law, the practical aspect of the ... 400
Elastic profanity ... 288
Electrical condenser, the ... 288
Electrical experiments, interesting ... 19
Electrical gas lighting ... 4
Electrical inventions, prizes for ... 201
Electrical transmission by cables ... 19
Electric block signals, railway ... 377
Electric current, experiments with the ... 99
Electric gas lighter ... * 35
Electric indicator of vitiated air ... 370
Electricity, religious ... 225
Electricity vs. yellow fever ... 372
Electrical light, a new ... 3.7
Electric light, novel ... 359
Electric light, the ... 199
Electric light, the new ... * 40
Electro-dynamic experiment, an ... 245
Electro-magnetism, recent progress of ... *351
Electro-music reporter ... 327
Electro-plating with tin ... 71
Electrotyping with iron ... 340
Elevation by barometer, finding ... 379
Eloquence and patent fuel ... 369
Embalming the dead ... 344
Embryology, Professor Haeckel on ... 21
Emery grinder, improved ... * 22
Enameled iron ... 245
Enamel, white ... 203
Energy, the manifestation of ... 228
Engine, a railroad fire ... 167
Engineering papers, subjects for ... 356
Engine, portable ... *119
Engine, rotary steam ... * 47
Engines, bisulphide of carbon ... 117
Engines, combined steam and bisulphide ... 212
Engines, hot air ... 101
Engines, torpedo boat ... *129
Engine, straw-burning steam ... 214
Engine, the bisulphide auxiliary ... 260
Engine, the hot air ... *37, 149, 260
Engine, the K. M. I. steam ... *335
Engine, the largest steam ... 118, 169
Engine, the three cylinder ... *291
Engine turning with the American chuck ... *309
Engine valves, caloric ... *149
Engraving, new method of ... 323
Ether, the manufacture of ... 245
Evaporation by plants ... *227
Exhibition at Montreal ... 115
Expansion per horse power, the measure of ... 402
Explosive projectiles ... 117
Explosives, heat of ... 262
Explosives, power of ... 129
Exposition awards ... 210
Exposition in Brooklyn, N. Y. ... 71
Expositions, the industrial ... 232
Exposition, the Cincinnati ... 231

F

Fan, the first automatic ... *119
Ferry boat, an ice-cutting ... 135
Fertilizer, horticultural ... 133
Fibrin as a diet, artificial ... 133
Files, to clean ... 374
Filtering apparatus, automatic ... 185
Fire alarm, a cheap ... 5
Fire alarm, improved ... 50
Fire engines, self-propelling ... 72
Fire escape, a new ... *38
Fire for life buoys, inextinguishable ... *258
Fire ladders ... 7
Fires on board ship, preventing ... 200
Fireworks, hydraulic ... 130
Fish, Chinese fresh water ... *407
Fish, Chinese method of catching ... 407
Fish commission explorations ... 309
Fish culture by farmers ... 17
Fishes from cannel coal ... 185
Fishing rod, improved ... *98
Fish, odd ... 312
Fish way in the Connecticut river ... 358
Flax and its preparation ... *371
Flies and mosquitoes, preventive for ... 391
Floral decoration, hints for ... 401
Flowers by insects, fecundation of ... *243
Fluorene ... 273
Fluorescence in chemical compounds ... 228
Foam on tonic beer ... 107
Fog signals ... 309
Fossil man of Mentone, the ... 243
Fountain, drinking, Regent's Park, London ... * 63
Fountain, the crystal self-acting table ... *406
Freezing compounds ... 76
French Association for the Advancement of Science ... 145
Friction attachment, improved ... *150
Frigorific effects of capillarity and evaporation ... 403
Frogs, a shower of ... 17
Fruit safes ... 37
Fruit trees, budding ... 200
Fuel, a new—Carbonite ... 384
Fuel, cinder ... 162
Fuel, economy of ... 23
Fuel, enormous waste of ... 169
Fuel, manufacture of artificial ... *319
Fuels, heating power of ... 52
Furnace for buildings ... *295
Furniture, to improve ... 73
Fusion, points of ... 326

G

Gage, quick change of ... 359
Gage, the Globe steam ... *231
Galena, bisulphide of potash and ... 354
Galvanic battery, a new ... 289
Gas apparatus, a new ... 402
Gas as a fuel ... 193
Gases, liquefying ... 310
Gases, petroleum and pine tar ... 272
Gases, the liquefiable matters in ... *292
Gases through membranes, passage of ... 241
Gas from crude petroleum ... 192
Gas-making, improvement in 304, *307
Gas, mineral oils for ... *71
Gas purifier and mixer ... 405
Gas, purifying coal ... 289
Gas retorts, charging, etc ... 70
Gas, the Kromschroder ... 52
Gas well in Michigan ... 248
Gas well, the greatest ... 49
Gate and signal, railroad ... *214
Gate, improved farm ... * 6
Gatling gun, another trial of the ... 308
Gatling gun trials, the ... 324
Gelatin solutions, preserving ... 340
Generation, spontaneous ... 112
Geological investigations, recent ... 112
Germ theory and its relation to hygiene, the ... 357, 376, 392
Gilding on china ... 43
Gilding on glass ... 250
Gillott, Mr. Joseph ... *271
Girders and floor beams, cross-bridging ... *53
Glass, water ... 266
Glazing cement wares ... 219
Glazing earthenware ... 251
Glucose ... 219
Glycerin, dissolving action of ... 6
Gold, ductility of ... 210
Gold dust and geese ... 324
Gold for dentists, crystal ... 124
Gold in Finland ... 231
Gold, large bar of ... 360
Gold plating solution ... 27
Gold, silver, etc., precipitating ... 123
Gold wash ... 395
Gout, remedy for ... 391
Governor, improved ... 50
Governor, turbine wheel ... *342
Granges and their object, the ... 128
Grate bars, burnt ... 196
Guano, curious substances in ... 257
Gulf stream, the cause of the ... 103
Gunnery trials, recent ... 227
Guns, new French field ... 264
Guns with petroleum, cleaning ... 8
Gun, the most powerful ... 264
Gymnast, toy ... *406

H

Hairy men ... 407
Hammer, power spring ... *262
Hampton Normal Institute ... 5
Hand brake, railroad ... *198
Hard times, what to do in ... 320
Harper Brothers' periodicals ... 402
Hartford Boiler Inspection and Insurance Company's reports 21, 85, 136, 212, 296, 338
Hatchet, novel claw ... * 38
Hatching from cold eggs ... 85
Hayden exploring expedition, the ... 297
Hay fever ... 161
Hay rake and tedder ... *230
Heart and the circulation of the blood, the ... 178
Heat-conducting power of rocks ... 289
Heater and purifier, feed water ... *143
Heat, latent ... 64
Heel plate, boot ... *38
Heels, boot and shoe ... 53
Hell Gate ... 176
Hell Gate excavations, the ... 304
Henry, testimonial to Professor Joseph ... 385
Hero's fountain ... * 59
Highest land east of the Mississippi, the ... 169
Hippopotamus' birthday, the baby ... 370
Hoisting engine, the Challenge ... *355
Hoosac tunnel 40, 113, 180, 241, 321, 372, 405
Hoosac tunnel, completion of the ... 372
Hoosac tunnel, the alignment of the ... 405
Horse bit, the ... 377
Horse liniment ... 377
Horseshoers, a contest between ... 360
Hot atmospheres, working in ... 162
Hub lathe, improved ... *6
Hull Dock Company's new offices, the ... *387
Hulling stone, ironclad ... *150
Hydraulic mining in California, 310, 340
Hydrocarbons, aromatic ... 273

I

Ice caverns in Switzerland ... 326
Ice cream ... 251
Ice, experiments with ... 22
Ice machine, improved ... *79
Ice machine, the patent ... 177
Ice-making machinery at Vienna ... 339
Ignition from steam pipes ... 149
Indiana State exposition, the ... 182
Indian brass hatchet ... 70
Indigo, printing with ... 161
Indo-Russian railway, the ... 151
Induction, peripolar ... *259
Induction spark, augmentation of the ... 71
Industrial expositions ... 54
Infection, the nature of ... 152
Ink, black ... 203
Ink, invisible ... 139
Ink, marking ... 251
Ink, portable ... 139
Ink stains, removing ... 139
Inkstand, an inexhaustible ... 376
Ink, sympathetic ... 75
Insects, muscular force of ... 161
Interoceanic canal, the ... 390
Interplanetary telegraph, the ... 388
Inventing, the art of ... 241
Inventions patented in England by Americans, 9, 24, 41, 57, 73, 89, 105, 121, 137, 170, 186, 201, 217, 232, 249, 281, 297, 330, 346, 362, 394, 408
Inventions, property in ... 164
Invention, the mother of ... 32
Inventor, a great unrecognized ... 80
Inventors and authors, righ s of ... 68
"Inventors and mechanics, for" ... 132
Inventors, the natural rights of ... 68
Inventors, the rights of ... 37
Iron and steel exhibits of the West ... 329
Iron-clad vessels ... 15
Iron filings in tea, presence of ... 405
Iron from California, meteoric ... 85
Iron from corrosion, protecting ... 65
Iron, precipitating ... 363
Iron, Swedish ... 353
Iron to gases, permeability of ... 97
Iron trade, the state of the ... 288
Iron works at Merthyr.—Mr. R. Crawshay ... *370
Iron works, the panic and the ... 292
Ivory, artificial ... 130

J

Jack, the herculean lifting ... * 2
Javelle water ... 171
Jet—How and where obtained ... 404
Jonah and the Belgian Academy ... 401
Journal box, a good ... *152
Journal boxes, the wear of ... *275
Journalism ... 183
Jumping from railway trains ... *116
Journals, a preventive against hot ... 85

K

Kansas City, Mo., exposition at ... *151
Kid gloves, cleaning ... 379
Kingfishers and fish ... 101
Krupp's steel factory ... 49

L

Labor and machinery ... 387
Laboratory notes ... 340
Lacquer for brass ... 219
Lamp, automatic taper ... *402
Lamp and the spectroscope, the ... 308
Language of the future, the ... 120
Lard as an unguent ... 229
Lathe, an ancient ... *274
Lathing construction, fireproof ... *326
Launch Firefly, the steam ... *258
Lawns in midsummer ... 119
Lawyer's spare time, a ... 322
Lead in water, detecting ... 172
Lead on iron, depositing ... 139
Lead poisoning and its treatment ... 97
Leaf printing ... 348
Leaves, photographing ... 364
Lemonade from currents ... 118
Lemon syrup ... 266
Lenses, composite ... 117
Lenses, silica ... 177
Liebig, a statue of ... 291
Liebig, Baron Justus von ... *71
Lifeboat service, the national ... 169
Light and life ... 40
Light, a new powerful ... 247
Lighthouses, American ... *306
Lightning accident, a ... 97
Lightning, fatalities from ... 217
Lightning freak, a ... 153
Lightning freak, strange ... 260
Lightning rods ... 96
Lightning rods, hints on ... 144
Light, physiological action of ... 120
Light, velocity of ... 104
Lime, acid phosphate of ... 75
Lions, a trap to catch ... 217
Lithographic stone ... 40
Litmus and turmeric paper ... 155
Lobsters, cultivation of ... 36
Lock, combination ... 5
Locomotive, a compound ... 261
Locomotive, articulated ... *135
Locomotives without fire ... 200
Locomotive, the fireless ... 240, 358
Log house of Norway, the ... 136
Loom, Short's patent ... 167
Lubricator, improved ... *279

M

Machinery for the American market, English ... 326
Madder, vegetable and chemical ... 81
Magic lantern as a means of demonstration, the ... *163, *184, 200
Magic lantern, etc., the ... 211
Magic, the tricks of ... 373
Magnesia, the manufacture of ... 289
Magnet, the Jamin ... *383
Malleable iron castings ... 138
Mannitan ... 321
Mansion and museum combined, a *307
Marbled paper ... 357
Mars, the planet ... 210
Mars, the planet—Is it inhabited? *195
Matches, friction ... 75
Match safe, gas bracket ... *342
Mathematics, the study of ... 128
Measuring rod and divider, combined ... *406
Measuring wheel, blacksmith's ... *343
Meat from Australia ... 329
Mechanical power in Nature, the ... 324
Mechanic, the migratory ... 152
Metals, copying ... 340
Medical science in court ... 305
Member, the suppressed ... 369
Mennonites, the ... 153, 386
Mental atmosphere, the ... 167
Mercury, pure sub-iodide of ... 178
Mercury, thermal expansion of ... 212
Metals under stress, the behavior of ... 336
Meteoric investigations ... 97
Meteors, the August ... 137, 169
Meteors, the November ... 37, 321
Methyl green ... 177
Metric system in medicine ... 185
Mice, to destroy field ... 273
Middletown, N. Y., the institutions of ... 292
Miles' cave, Mass ... 309
Milk, alkaline ... 274
Milk refrigerator ... *83
Milk, sour ... 329
Mill pick, improved ... *273
Mineral oils, the geographical distribution of ... 198
Minerals, simple tests for ... 65
Mines and experts ... 210
Miracles, modern ... 160, 328
Miracles, the Lourdes ... 194
Moistening device for animals ... *406
Mold stains, removing ... 139
Molecules ... 312
Moles, how to catch ... *178
Money honestly, how to make ... 359
Morocco, the resources of ... 22
Mortar floors, Mexican ... 227
Moses, a, possible ... 223
Mosquito netting as a surgical dressing ... 292
Mosses, the Sullivant collection of ... 49
Moth preventive ... 388
Moth, the Great Leopard ... *36
Moth, the Isabella Tiger ... *51
Motor, a new ... 53
Motor, a new domestic ... *118
Mouse, the sea ... 406
Mowing and threshing, steam ... *35
Mowing machine, an early ... *2
Muscles, red and white ... 369
Mushrooms, preserving ... 329
Mustard, preparing ... 395

N

Nails, the price of ... 22
Name, the persistence of a ... 375
Naphthaline ... 41
Narrow gage cars ... 120
Nature and art ... *131
Nature, La ... 65
Navigation in a fog, skillful ... 154
Nebulæ, the ... 360
Nebular theory and Kepler's laws ... 149
Necessity the mother of invention ... 358
Nerve force, the origin of ... 164
New books and publications 9, 24, 73, 104, 121, 154, 201, 217, 265, 330, 394
Newspaper, the new daily ... 393
New York and Liverpool, daily service between ... 297
New York to London, new route from ... 129
Newt, exudation from the ... 162
Niagara, the future of ... 185
Nickel and ammonia, double sulphate of ... 139
Nickel-plated valves and seats ... 193
Nickel-plating solution ... 91
Nickel, sulphate of ... 75
Nickel, the uses of ... 372
Night soil from vaults, removing *255
Nitrate of silver stains, removing 282
Nitric acid on chromate of lead ... 245
Nitro-glycerin ... 123, 138
Nitrous oxide, solidification of ... 248
Notes and queries 11, 27, 43, 59, 75, 107, 123, 138, 155, 171, 203, 219, 234, 250, 266, 299, 315, 331, 347
Noon mark, to make a ... 234
Norway and Sweden ... 115
Nose, cure for bleeding ... 108
Nourishment for sick stomachs, liquid ... 392
Nuisance preventer, a ... 274

O

OBITUARY:
Adams, Seth ... 400
Allen, Jr., Phineas ... 49
Calvert, Grace ... 338
Foster, John W. ... 40
Hewes, Joseph L. ... 241
La Mountain, — ... 57
Landseer, Sir Edwin ... 241
Nélaton, — ... 289
Page, Ezekiel ... 113
Powers, Hiram ... 21
Ronalds, Sir Francis ... 166
Wakefield, Cyrus ... 309
Wanting, William ... 40
Ocean race of 17,000 miles, an ... 39
Oil, fish ... 53
Oil for fuel, crude ... 260
Oil pipes, three hundred miles of ... 216
Oil, purifying lubricating ... 8
Oils for iron, mineral ... 231
Oil well at Newark, N. J., an ... 83
Oil wells, flowing ... 128
Oil wells of the United States, the ... 276
Okeechobee, Lake ... 88
One hundred miles an hour ... 88
Opeloscope, the ... 342
Opium, effects of ... 65
Optical instrument, new ... *152
Oranges and lemons, packing ... 229
Organic substances and combustion ... 354
Ornaments, simple ... 358
Outrage? is it a dastardly ... 80
Outrage, that dastardly ... 112
Ox bow, improved ... *66
Oxygen gas, easy method for ... 315
Oxyhydrogen light, the ... 329
Oxymaleic acid ... 49
Ozone by slow oxidation ... 65
Ozone generator, new ... 50, *167

P

Paint for canvas, waterproof ... 137
Painting on zinc ... 348
Paintings, restoration of ... 225
Paint, to remove ... 129
Palinurus, the ... 66
Palm of Brazil, the *pashiuba* ... *359
Palm, the *oreodoxa regia* ... *371
Panic and the laboring classes, the ... 304
Panic over, the ... 240
Paper-feeding machine ... *98
Paper making, wood and straw ... 272
Paper manufacture, statistics of ... 274
Paper, new style of ... 164
Paper trade, the American ... 71
Papers, uses of waste ... 120
Paraffin gas ... 88
Pardee Hall and its founder ... *339
Parks, the department of, New York city ... 192
Patent, an old sewing machine ... 224
Patent congress, a ... 7
Patent congress at Vienna, the ... 144
Patent congress, end of the ... 160
Patent congress once more, the Vienna ... 192
Patent congress, the Vienna ... 356
Patent decisions of the courts 24, 73, 89, 105, 121, 154, 186, 361, 378, 393
Patent law discussion, the ... 53
Patent litigation, important ... 262
Patent Office, business in the Canadian ... 97
Patent Office, lady clerks at the ... 150
Patent Office, the year's business at the ... 343
Patent planing machine litigation ... 240
Patent right question, the 84, 132, 212
Patents for simple things ... 336
Patents in the United States, early ... 385
Patents, new order by the Commissioner of ... 272
Patents, official list of 12, 28, 44, 60, 76, 92, 108, 124, 140, 156, 172, 188, 204, 220, 235, 252, 267, 283, 300, 316, 332, 348, 364, 380, 395, 409
Patents, official list of Canadian 396, 410
Patents, on the purchase of ... 368
Patents, progress of ... 272
Patents, property in ... 371
Patents, recent American and foreign 9, 24, 41, 57, 73, 89, 105, 121, 137, 154, 170, 186, 201, 217, 232, 249, 265, 281, 297, 313, 329, 345, 361, 378, 393, 408
Patents, system for selling ... 377
Patents, the value of ... 336
Patents, value of foreign ... 199
Pavements, street ... 257
Pavement, the coming ... 16
Peat for fuel ... *1
eat, on ... 273
Pen conundrum, steel ... 292
Pens and their failings ... 177
Permeator, self-feeding ... *278
Perpetual motion for sale, a ... 261
Perpetual motion seeker, the ... 308
Perpetual motion wanted, a ... 196
Persimmon coffee ... 325
Petrified trees in Colorado ... 67
Petroleum as fuel ... 340
Petroleum for fuel and gas ... 208
Petroleum for fuel, crude ... 257
Petroleum, gas from crude ... 260
Petroleum in Burmah ... 305
Petroleum, temperature indicator for ... 358
Phenantrene ... 38
Phenolcyanine ... 67
Phosphates for yeast powders ... 51
Phosphates in food for lambs ... 343
Phosphor-bronze ... 155, 337
Phosphor-bronze gears ... 136
Phosphoric compounds ... 232
Phosphorus thought? is ... 195
Phosphur-tungstic acid ... 81
Photo baths, to clear ... 295
Photo-chemical engraving ... 63
Photographic purposes, yellow glass for ... 113
Photographs in natural colors ... 344
Photographs of invisible substances ... 289
Photography, instantaneous ... 65
Photography of the invisible ... 353
Photography, stellar ... 67
Photography with gelatin, dry ... 373
Photo-lithography, improvement in ... 405
Photo process, new ... 115
Physical and mental over culture ... 337
Pianos are injured, how ... 224
Picks, mining ... 134
Picture, a useful and interesting ... 5
Pigeon, a mechanical ... *18
Pig feeder ... *66
Pig ironists in council, the ... 17
Pinchers, shoemaker's ... *223
Pine, the yellow ... 132
Pinoline ... 386
Pipe coupling ... *374
Pipe stems, jasmine ... 303
Pistol trade, the ... 113
Plagues, origin of ... 115
Plane, improved match ... *231
Planetary communication, inter ... 309
Planetary motion ... *275
Planets, new ... 5
Planing machine patents, the ... 7
Plants, aqueous exhalation of ... 405
Plants by artificial clouds, protecting ... 369
Plaster casts, to harden ... 68
Plastic composition, new ... 86
Plaster of Paris, the manufacture of ... *399
Plated ware manufacturers ... 18
Plating iron with brass ... 299
Plating solution, silver ... 12, 299, 315
Platinum and palladium on hydrocarbons, action of ... 242
Plow attachment ... *214
Plowing by direct traction, steam ... *15
Plow points, changeable ... 66
Pneumatic tubes, ammonia in ... 177
Pneumatic tubes, locating obstructions in ... 98
Poison, a remarkable ... 194
Poisonous undershirts ... 201
Polaris, the survivors of the ... 209
Polish, French ... 266
Poor man's representative, the ... 144
Porpoise, the ... 153
Postal science ... 304
Potato blight and rot ... 279
Potato disease, a chemical remedy for the ... 198
Power, the measurement of ... 16
Preserving specimens from insects ... 404
Press for fruit, etc ... *2, 9
Printing presses in America, English ... 321
Printing press, new ... 160
Prismoidal railway ... 370
Prizes for improvements ... 341
Probabilities, Old ... 8
Proctor, Mr. R. A. ... 288
Projectiles, the initial velocity of ... 400
Propeller, chain ... *70
Propeller, improved ... *66
Propeller, helicoidal ... *263
Propeller, the hydraulic ... *166
Propylene, new chlorides of ... 8
Psychic force on the slate ... 4
Psychology, an obscure phenomenon in ... 393
Publishers' card ... 384, 400
Puddle walls ... 240
Pulleys, elliptic ... *308
Pulleys, loose ... 184
Pulsometer or steam pump, the ... *127
Pump, friction geared centrifugal ... *402
Pump, double acting steam ... *88
Pump for sewage, air ... *99
Pump for steamers, safety ... 66
Pumps, improvement in ... 99
Putnam, statue of General ... 73
Pyrites, reduction of auriferous ... 329

Q

Quicksilver, the price of ... 145

R

Railroad depot at Washington, D. C. ... 67
Railroads, European ... 369
Railroads in the United States ... 97
Railroads, wooden ... 324
Railway, automatic wire rope ... *191
Railway bonds, depression in ... 367
Railway, Cairo and Jackson ... 212
Railway dead weights ... 200
Railway depot, the largest ... 119
Railway disasters, remarkable ... 153
Railway enterprise, check to ... 232
Railway, hillside ... *239
Railway in Turkey, underground 264
Railway, New York and Long Branch ... 214
Railway passengers in Great Britain ... 277
Railway religion ... 297, 340
Railways in America ... 130
Railways in Great Britain and the United States ... 404
Railways of Massachusetts ... 5
Ramming the mold ... *322
Rat poison ... 332
Rats, catching ... 67
Rat trap, a novel ... 182
Rectifying and filtering spirits ... *374
Refraction, atmospheric ... 389
Resins ... 328
Restoring the color of ink ... 220
Reversing gear for rolling mills ... *130
Rheumatism ... 373
Rhodium, oil of ... 108
Rigi railway, the ... *194
Roller and irrigator ... *280
Route between America and Europe, a new ... 404
Rubber, a new substitute for ... 49
Rubber, bleaching ... 171
Rubber, molding ... 283
Rubber, white ... 139

S

Saddle trees ... 120
Safety valve levers ... 87
Safety valve, proportions of ... 363
Sailing faster than the wind ... 132
Saliva and blood ... 6
Salt, common ... 115
Sand bars, removing ... 2
Sand club, the ... 167
Sandstone, tracks in ... 340
Sash cord fastener, improved ... *115
Sash fastener, improved ... *259
Sash lock, holder, and weather strip ... *226
Savings banks, prize essays on ... 292
Saw and swage, planer-toothed ... *294
Sawdust stockings ... 152
Sawfish cuts a telegraph cable, a *34
Saw, the work of a circular ... 72
Scagliola ... 123
Science and health ... 345
Science in the kitchen ... 353
Science, the savings of ... 373
Scientific American in Prussia, a ... 66
SCIENTIFIC AMERICAN, special edition of the 276, 281, 305, 325, 369
Scientific American, value of the 53, 99, 200
Scientific and practical information 8, 49, 65, 81, 104, 113, 129, 161, 177, 193, 225, 241, 257, 273, 289, 305, 321, 337, 353, 369, 405
Scientific college, a new ... 39
Scientific education, progress of ... 288
Scientific experiments, prizes for ... 372
Scientific fun ... 185
Scientific immortality ... 19
Scientific prizes ... 4
Scientific prophets ... 388
Scientists, decorated ... 321
Screw propulsion ... 391
Screws in plaster walls ... 53
Screw, the effect of immersion on a ... 213
Screw threads, proportions of ... 7
Secondary currents and their applications ... 387
Seidlitz powders ... 331
Sewage, the value of ... 329
Sewer gas trap ... *326
Sewers, ventilation of ... *232
Sewing machine awards at Vienna ... 145
Sewing machine, sole ... 136
Sewing machine, that ancient ... *260
Sewing machine tucker ... *70
Sexadigitism ... 376
Sheep shears, lightning ... *310
Shipbuilding in Iowa, iron ... 103
Ship canal through Syria ... 188
Ship construction, composite ... *23
Ships, circular ... *275
Shoe and Leather Chronicle, the ... 53
Signal lights, ship ... 102
Signal service report, the ... 352
Silkworm and moth, the Pernyi ... *67
Silkworms, food for ... 313
Silkworm, the Cecropia ... *87
Silver, oxidized ... 219
Silver, precipitating ... 219
Silver, recovery of ... 249
Siphons for canals, concrete ... *130
Skeletonized leaves ... 123
Slag as a building material ... 371
Slate roofing paint ... 194
Slicer, fruit and vegetable ... *294
Smokometer, the ... 216
Snake bites, cure for ... 161
Snake poison ... 372
Snake poisons ... 33
Snakes swallow their young? do ... 185
Snow and earth shovel and plow, combined ... *374
Snow melter, a steam ... 384
Soap soluble in sea water ... 345
Societies among college students, secret ... 272
Softening chilled castings ... 395
Softening water ... 107
Soldering brass ... 251, 364
Solders, dentist's ... 405
Sophora of Japan, the weeping ... *402
Sounding instrument, sea ... *243
Soundings, deep sea ... 4, *21, 164, *235
Sounding tubes, the nodal points in ... 405
Sounds, analysis of composite ... 328
South, life in the ... 386
Spade and fork, combined ... *198
Specific gravity indicator ... *35
Specific heat ... 208, 248
Spectra, secondary ... 217
Spectrograph, the ... 329
Spectrum analysis, a new application of ... *82
Spectrum analysis, quantitative 345
Speculum plates, ruled ... 208
Speech, tongueless ... 373
Spiritualism not patentable ... 305
Spontaneous combustion of hydrocarbon vapors ... 389
Spontaneous generation ... 196
Squares, magic ... 389
Squaring the circle ... 200
Star Algol, the variable ... 275
Starch into sugar, conversion of ... 104
Star shower of August 10, the ... 81
Stars, shooting ... 289
Steam cultivation, progress of ... 98
Steam, effects of air on ... 71
Steam, efflux of ... 113
Steamer, novel ... 343
Steamers, small fast ... 185
Steam motor, new ... *194
Steam organ, a new ... 49
Steam pipes, covering for ... 295
Steam, properties of saturated ... 81
Steamships, two new ... 341
Steam wagon, a ... 5
Steel ... 264
Steel, American ... 289
Steel, annealing ... 107
Steel furnace, the Siemens ... 263
Steel, modes of making ... 2
Steel, Mushet ... 177
Steel works, Krupp's ... 181
Stereoscope for large pictures ... *29
Stereoscopic transparencies, finishing ... 183
Sting of a wasp and a needle ... *151
St. Louis flour ... 309
Stock-breeding, American progress in ... 201
Storm glass ... 123
Stove, ventilating and heating ... *94
Stray, John ... 88
Street nomenclature ... 20
Street travel ... 52
Subscribers, a word to our ... 368
Subscribers, to our ... 134
Subways, Holborn viaduct ... *303
Sugar chemical ... 192
Sugar-making process, improved *367
Sulphate of alumina, testing ... 113
Sulphate of ammonia from waste ... 6
Sulphite of soda as an antichlor ... 104
Sulphur water in iron pipes ... 2
Sun and moon, heat of the ... 39
Sun, retrogression of the ... *51, *101
Sun spots, theories of the ... 160
Sun's surface, the ... 309
Sun, the metals of the ... 72
Surgeons, perils of ... 8
Surgical discovery, a new ... 65
Swan, the black necked ... *343
Switches, safety railway ... 294
Switch, railroad ... *262

T

Table, dining ... 134
Tallow, to purify ... 182
Tanning in Europe, calfskin ... 211
Taxes on knowledge ... 310
Tea, adulteration of ... 369
Tea, analysis of ... 289
Teapot, ink in the ... 375
Technical research and education ... 256
Telegraph cables, overhead ... 23
Telegraph cables, the Atlantic ... 41
Telegraph carriage, postal ... *323
Telegraph code, an easy ... 401
Telegraphing maps and plans ... 263
Telegraph instrument, a new ... 5
Telegraph pole, metallic ... *35
Telegraph, the miniature ... *354
Telegraph, the multiplex ... 197
Telegraph, the Tom Thumb ... 354
Telegraphy at the exposition, French ... 64
Telescope of unlimited power, concerning a ... 368
Telescope, the million dollar 51, *100, 133, 228, 320
Telescope, the proposed great ... 149
Temperature, molecular changes by variations in ... 304
Tempering small tools ... 315
Tempering springs ... 251
Tempering steel and burnt iron ... 405
Tent attachment for life boats ... *294
Tent roof garden chair, the ... 405
Testing machine, improved ... *152
Test plates, microscopic ... 231
Textile plant, new ... 289
Thallium from Vesuvius ... 65
Thames, the outlet of the ... 274
Thermo-electric battery, a ... 24
Thermometer, an imperial ... 353
Thurston, letters from commissioner ... 16
Tin, coating fabrics with ... 81
Tin for filling teeth ... 57
Tinning brass articles ... 60
Tin plate is made, how ... 377
Tin, protochloride of ... 75
Toad in the rock, a ... 212
Tool, combination ... *339
Tool holder, slide rest ... *67
Torch, improved ... *328
Torpedo boat, a new ... 338
Torpedoes, the Lay and Porter ... *31
Torpedo, the Lay ... 101
Touchstone for gold ... 107
Towing sailing vessels ... 96
Trade mark decision, a ... *342
Trains in England, fast ... 310
Transferring motion, device for ... *182
Trap, animal ... *242
Travel between America and Europe ... 294
Tree protector, a simple ... *210
Trees as historians of the past 340, 372
Trees, girdling ... 108
Trees, to measure the hight of ... 83
Tungsten in the arts ... 104
Tunnel at West Point, N. Y. ... 180
Tunnel between Scotland and Ireland ... 327
Tunnel, the Sierra Madre ... 153
Tunnel through Jersey City Hights ... 176

U

Underground railways in cities ... 32
Underground railway, the London ... 199
Undershirts, poisonous ... 262
Union men, trades ... 136

V

Varnish, elastic ... 282
Varnish for tin boxes ... 43
Varnish for zinc, black ... 118
Varnish on metal, black ... 123
Varnish, waterproof ... 219, 251
Vassar college, statistics of ... 292
Vegetable tissue ... 181
Ventilation of the Senate chamber ... 372
Ventilators, car ... 132
Vermillion for dental purposes ... 54
Vienna, Corliss engines at ... 69
Vienna exposition, notes from the ... 5, *19, *34
Vienna exposition, prizes at the ... 144
Vienna exposition, steam boilers at the ... 148
Vienna exposition, the architect and builder of the ... *147
Vienna exposition, the.—Letters from Professor R. A. Thurston, 20, 36, 52, 69, 85, 100, 116, 133, 148, 165, 181, 197, 213, 229, 248, 261, 277, 293
Vienna, exposition, the machine hall at the ... *146
Vienna exposition, visitors to the 326
Vienna, honors to operatives and foremen at ... 280
Vienna, photography at ... 99
Vienna premiums and sewing machines ... 185
Vienna premiums for sewing machines ... 201
Vienna prizes, the ... 176, 256
Vienna, reaping trials at ... 99
Vienna show, the ... 80
Vienna, the Japanese department at ... *279
Vienna, the Persian pavilion at ... *167
Vienna, the Turkish pavilion at ... *183
Vienna, triumph of American harvesters at ... 96
Ville du Havre, the loss of the ... 384
Vinegar, the manufacture of ... 68
Vitriol, manufacture of *111, 114, 115
Volume, measurement of ... 309

W

Warm weather, artificial ... 309
Washer, improved steam ... *98
Washing machine, improved ... 50
Watches and pockets ... 354
Water and pressure gage, combined ... *198
Water as fuel ... 37, 212, 376
Water closet, odorless ... *102
Water coolers and filters, Mexican ... *275
Water cooler, the Australian ... 102
Water gas ... 178
Water, impure ... 388
Watering house plants ... 120
Water in pipes, friction of ... 48, 113
Water on lead, action of ... 57
Water pipes, incrustation of ... 198
Water supply of Paris, the ... 309
Water supply of Rome, the ... 342
Water wheel, improved turbine ... *166
Weather strip, window ... *150
Weather vane, a new ... 405
Wellesley College ... 54
Whale caught by a telegraph cable, a ... 360
Whales ... 223
Whips, improved ... 165
White lead from oil, freeing ... 91
Wild animals, collecting ... 39
Wild beasts and snakes in India ... 274
Wine, detecting adulteration of ... 405
Woman's rights, progress of ... 7
Wood, the preservation of ... 120
Worcestershire sauce ... 251
Worm, the hair ... 275
Worry, the effects of ... 278
Wrench, improved ... *150
Wrinkles, two ... 388

Y

Yucca pendula, the ... *359

Z

Zinc bandages in surgery ... 341
Zincing iron ... 376
Zinc, the use of ... 65
Zodiacal light, the ... 49, *101
Zodiacal light, the cause of the ... *51

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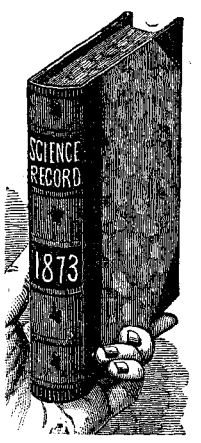

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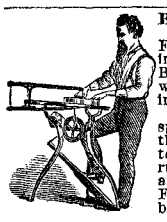

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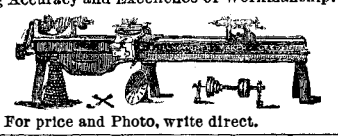

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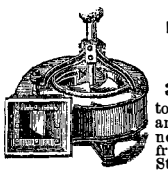

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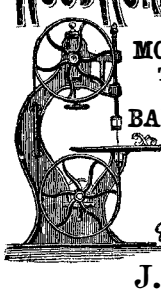

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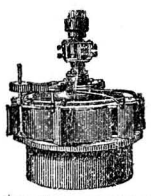

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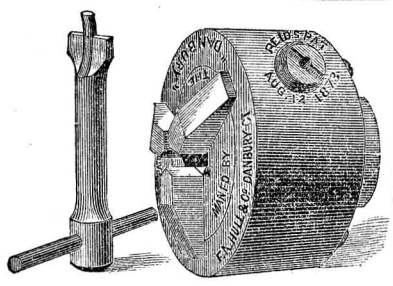

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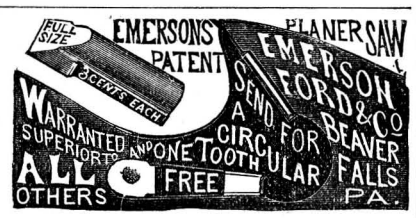

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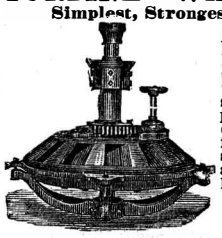

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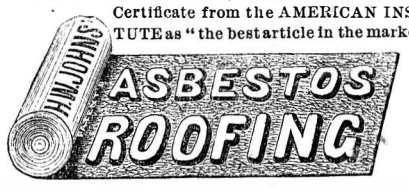

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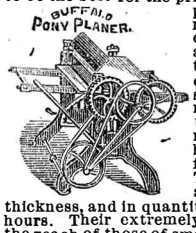

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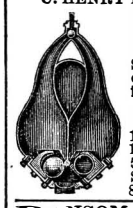

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